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Length Data for Four Cyprinid Species in Lake 302, a Double-Basin Acidified Lake in the Experimental Lakes Area, Northwestern Ontario

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R3T 2N6

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by

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ABSTRACT

Chalanchuk, S.M., L.C. Mohr, and D.J. Allan. 1991. Length data for four cyprinid species in Lake 302, a double-basin acidified lake in the Experimental Lakes Area, northwestern Ontario. Can. Data Rep. Fish. Aquat. Sci. 846: iv + 43 p.

Length-frequency data are presented for four species of Cyprinidae in Lake 302, in the Experimental Lakes Area, northwestern Ontario: pearl dace (Semotilus margarita), fathead minnow (Pimephales promelas), finescale dace (Phoxinus neogaeus), and northern redbelly dace (Phoxinus eos). From 1982 until 1990, the north basin (L302N) received additions of nitric or hydrochloric acid; during this time period, the south basin (L302S) received additions of sulphuric acid.

Key words: fork length; pearl dace; Semotilus margarita; fathead minnow; Pimepales promelas; finescale dace; Phoxinus neogaeus; northern redbelly dace; Phoxinus eos; pH; sulphuric acid; nitric acid; hydrochloric acid.

RÉSUMÉ

Chalanchuk, S.M., L.C. Mohr, and D.J. Allan. 1991. Length data for four cyprinid species in Lake 302, a double-basin acidified lake in the Experimental Lakes Area, northwestern Ontario. Can. Data Rep. Fish. Aquat. Sci. 846: iv + 43 p.

On présente des données sur la fréquence de longueurs de quatre espèces de cyprinidés vivant dans le Lac 302 de la Région des Lacs Expérimentaux située dans le nord-ouest de l'Ontario: le mulet perlé (Semotilus margarita), le tête-de-boule (Pimephales promelas), le ventre citron (Phoxinus neogaeus) et le ventre rouge du nord (Phoxinus eos). De 1982 à 1990, le bassin septentrional (L302N) à reçu des apports d'acide nitrique ou d'acide chlorhydrique et le bassin méridional (L302S), des apports d'acide sulfurique.

Mots clés: longueur à la fourche; mulet perlé; Semotilus margarita; tête-de-boule; Pimephales promelas; ventre citron; Phoxinus neogaeus; ventre rouge du nord; Phoxinus oes; pH; acide sulfurique; acide nitrique; acide chlorhydrique.

INTRODUCTION

The purpose of this report is to present data on the cyprinid populations in Lake 302, in the Experimental Lakes Area (ELA), northwestern Ontario. The Cyprinidae in Lake 302 are pearl dace (Semotilus margarita), fathead minnow (Pimephales promelas), finescale dace (Phoxinus neogaeus), and northern redbelly dace (Phoxinus eos).

Several researchers have recently documented the sensitivity of some species of Cyprinidae to acidification (Rahel and Magnuson 1983; Mills and Schindler 1986; Pauwels and Haines 1986). According to these studies, the pH thresholds for occurrence of the four species of cyprinids present in L302 are approximately 5.2 to 5.9. Reproductive impairment of these species likely occurs at even higher pH values, as shown by McCormick et al. (1989) for fathead minnow. The initiation of an acidification experiment in L302, a double-basin lake in the ELA, provided an opportunity for monitoring the population responses of the cyprinids to decreasing values of pH caused by different acids.

In this report, we present length-frequency data for four species of cyprinids in L302 from 1982 until 1990.

MATERIALS AND METHODS

Lake 302 is a small, double-basin lake in the ELA. The two basins are separated by a vinyl-impregnated nylon curtain. The north basin, L302N (area = 12.8 ha, maximum depth = 13 m, mean depth = 5.7 m), is quite similar to the south basin, L302S (area = 10.9 ha, maximum depth = 10 m, mean depth = 5.1 m) in size and depth.

Each basin has undergone acidification since June, 1982. L302N has received additions of nitric acid (HNO_3) from 1982 to 1986 and of hydrochloric acid (HCl) from 1987 to 1990. Time-weighted mean epilimnetic pH decreased from 6.71 in 1982 to 5.04 in 1989 (Cruikshank 1990) and was 5.18 for 1990 (D.R. Cruikshank, Freshwater Institute, Winnipeg, Manitoba, personal communication). L302S has received additions of sulphuric acid (H_2SO_4) from 1982 to 1990. Time-weighted mean epilimnetic pH has decreased from 6.25 in 1982 to 4.53 in 1989 (Cruikshank 1990) and was 4.52 for 1990 (D.R. Cruikshank, personal communication). Further information on bathymetry, background chemistry, and acid additions to Lake 302 can be found in Brunskill and Schindler (1971); Linsey et al. (1985); Cruikshank (1984, 1986, 1990). Information on previous experiments conducted in L302 or on other biological aspects of the acidification experiment can be found in Schindler et al. (1980); Chalanchuk (1986); Findlay and Kasian (1990).

Fish were sampled monthly during 1982 and 1983, and seasonally (spring and fall) from 1984 to 1990. They were primarily captured by modified versions of small-mesh (mesh size = 5-6.5 mm) Beamish-style trap nets (Beamish 1972) throughout the study. Trap nets were set for two or three day periods. Catches of less than five hundred fish were sampled completely; larger catches were usually subsampled. In 1982, commercial wire-mesh (mesh size = 5 mm) minnow traps were also used to capture fish. Each fish was measured for fork length to the nearest mm. Length-frequency histograms were constructed on a monthly basis for each species of fish. Histograms were not constructed for sample sizes of less than 15 fish. No fathead minnow were captured in either basin in 1989 and 1990.

ACKNOWLEDGMENTS

This study was funded by Fisheries and Oceans. We thank Dr. K. Mills for his help throughout the study. Thanks also to Dr. D. Bodaly for his useful comments on the manuscript.

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Table 1. Summary of figures designated by species, lake basin, and year.

Species	Lake basin	Year	Figure
Pearl dace	302N	1982-1990	1a-1i
Pearl dace	302S	1982-1990	5a-5h
Fathead minnow	302N	1982-1987	2a-2e
Fathead minnow	302S	1982-1987	6a-6c
Finescale dace	302N	1982-1989	3a-3e
Finescale dace	302S	1982-1984	7a-7c
N. redbelly dace	302N	1982-1989	4a-4c
N. redbelly dace	302S	1982-1983	8a-8b

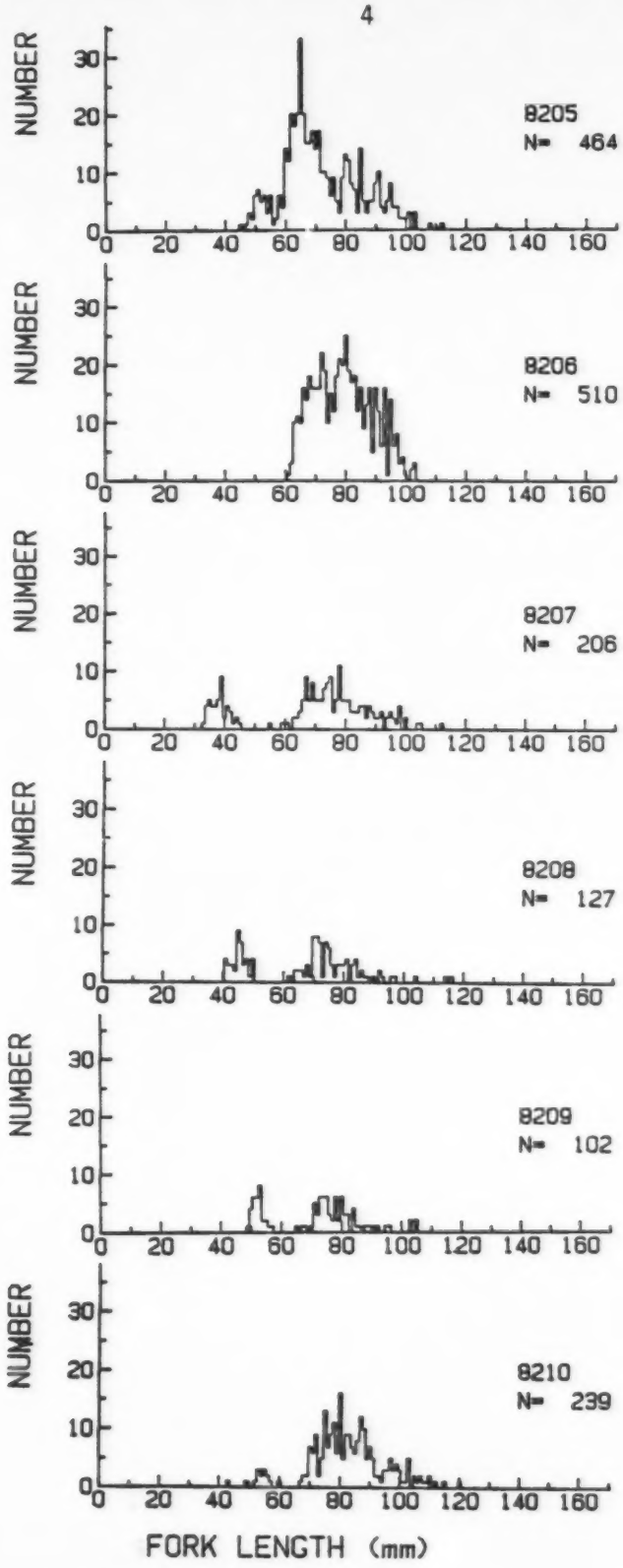

Fig. 1a. Monthly length-frequency distributions for pearl dace in L302N from May, 1982 (8205) until October, 1982 (8210).

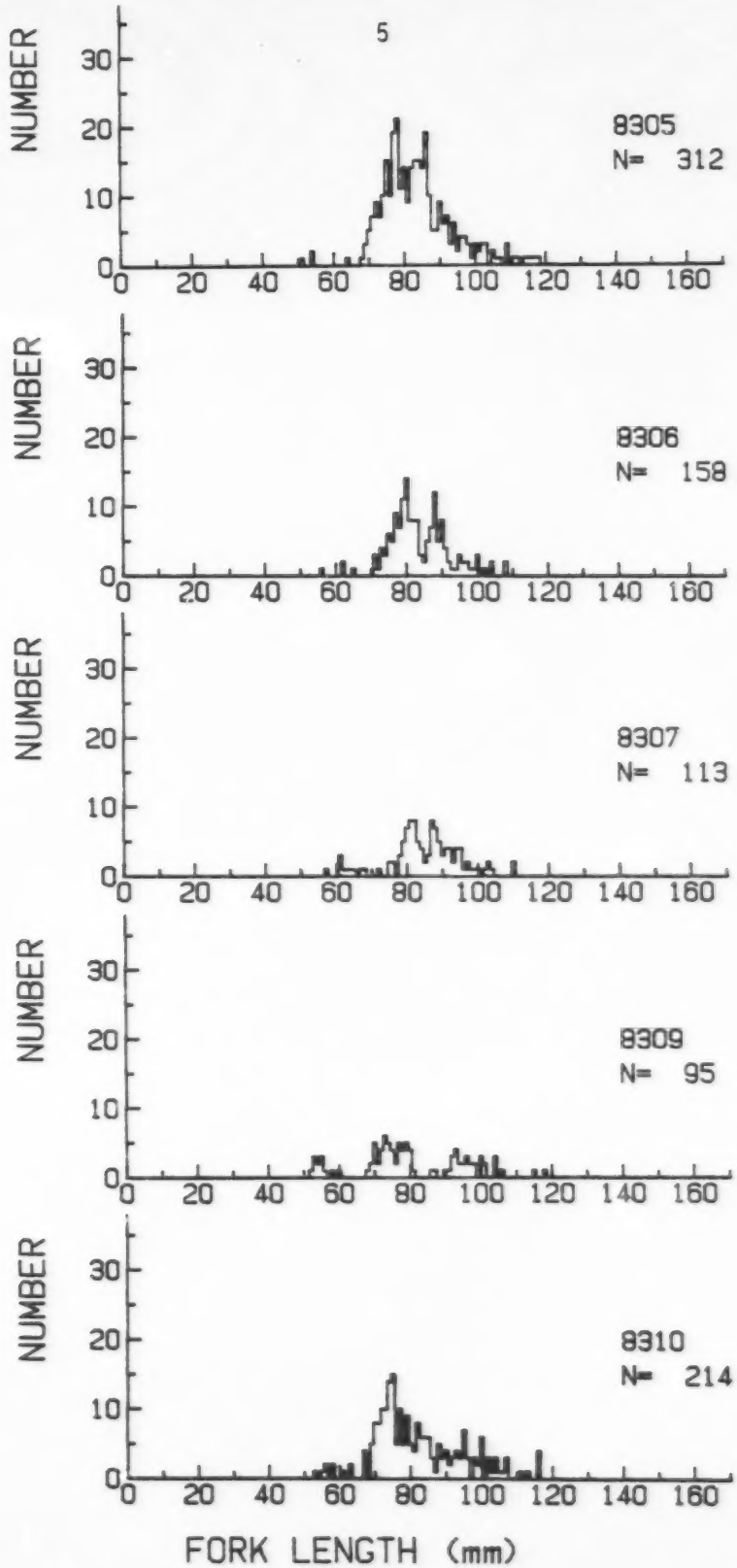

Fig. 1b. Monthly length-frequency distributions for pearl dace in L302N from May, 1983 (8305) until October, 1983 (8310).

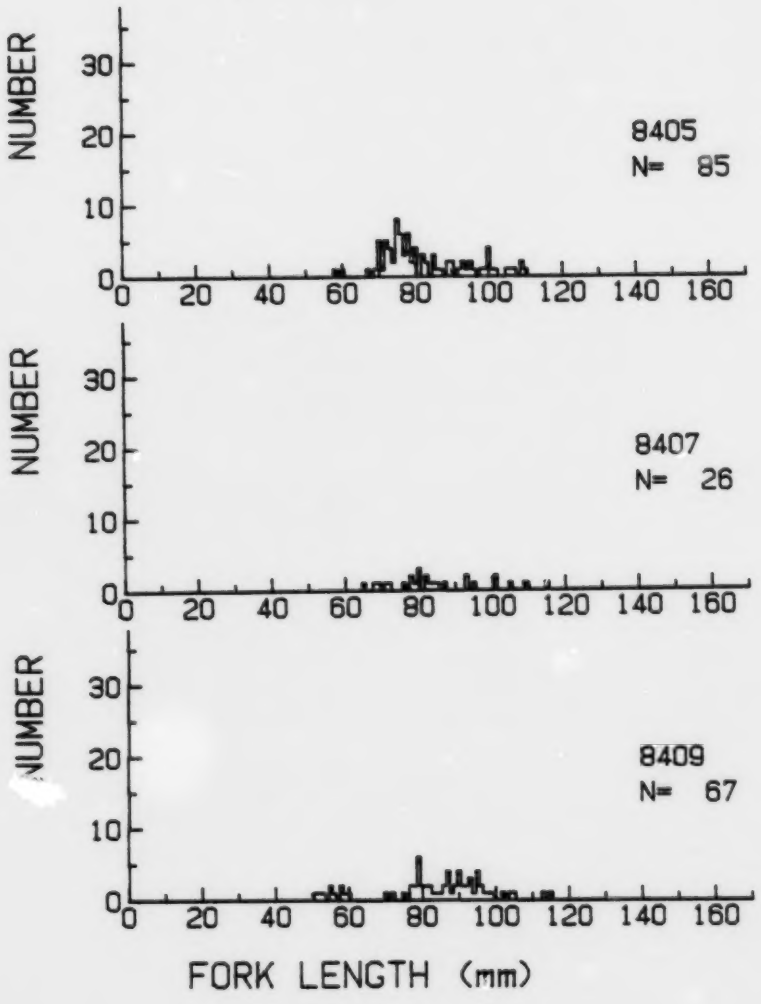

Fig. 1c. Monthly length-frequency distributions for pearl dace in L302N from May, 1984 (8405) until September, 1984 (8409).

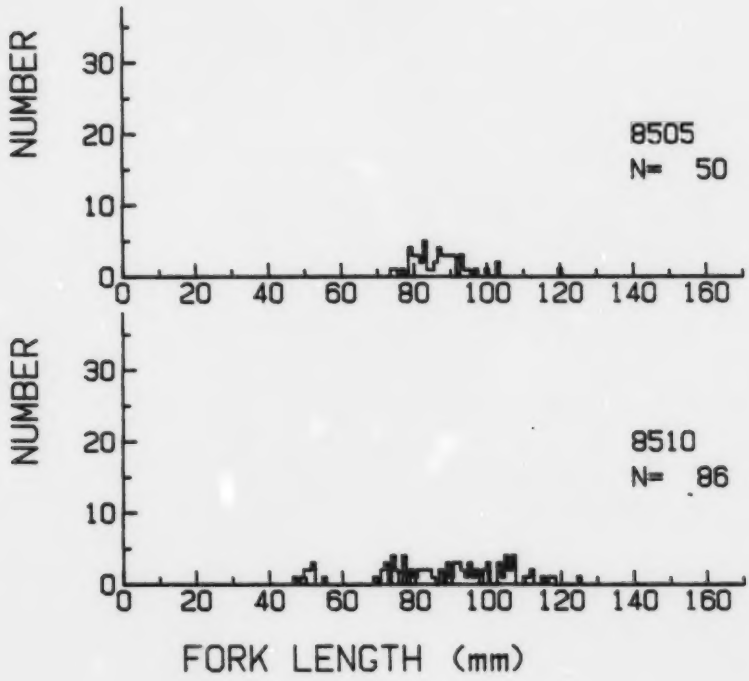

Fig. 1d. Monthly length-frequency distributions for pearl dace in L302N for May, 1985 (8505) and October, 1985 (8510).

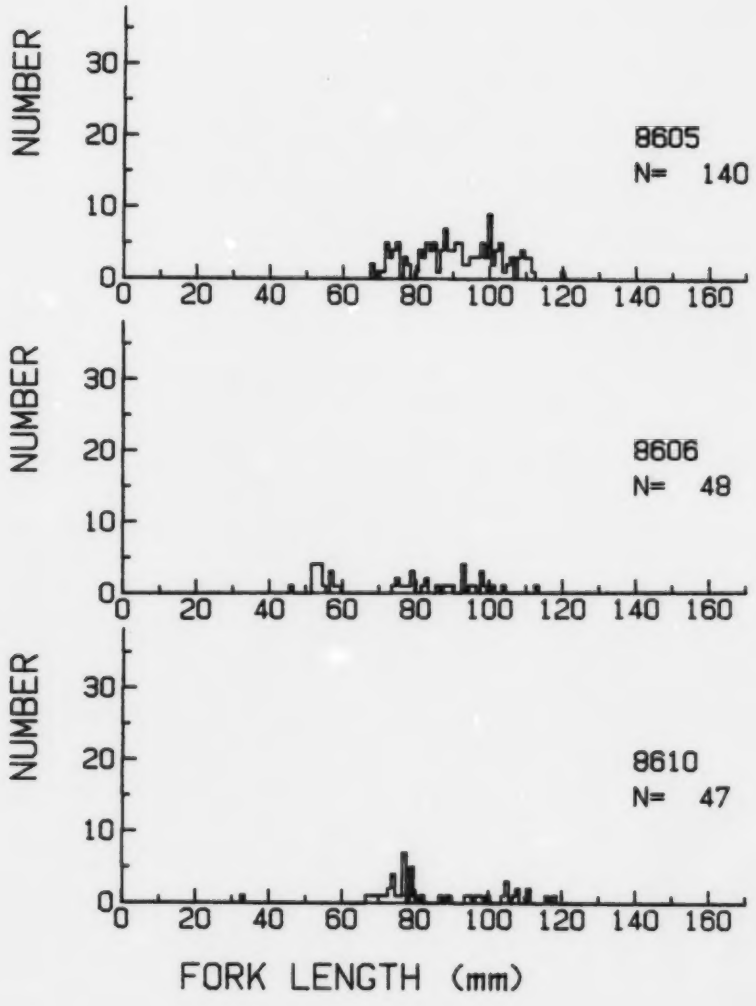

Fig. 1e. Monthly length-frequency distributions for pearl dace in L302N from May, 1986 (8605) until October, 1986 (8610).

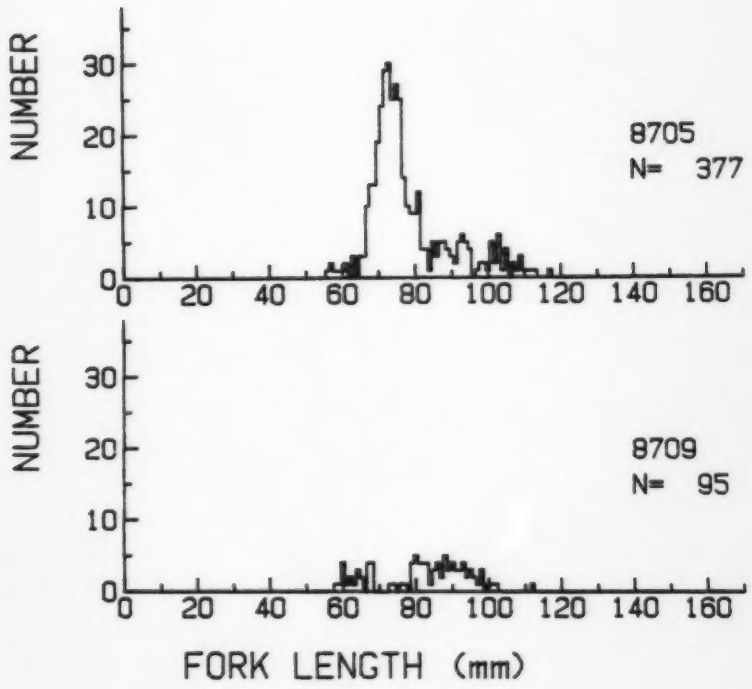

Fig. 1f. Monthly length-frequency distributions for pearl dace in L302N for May, 1987 (8705) and September, 1987 (8709).

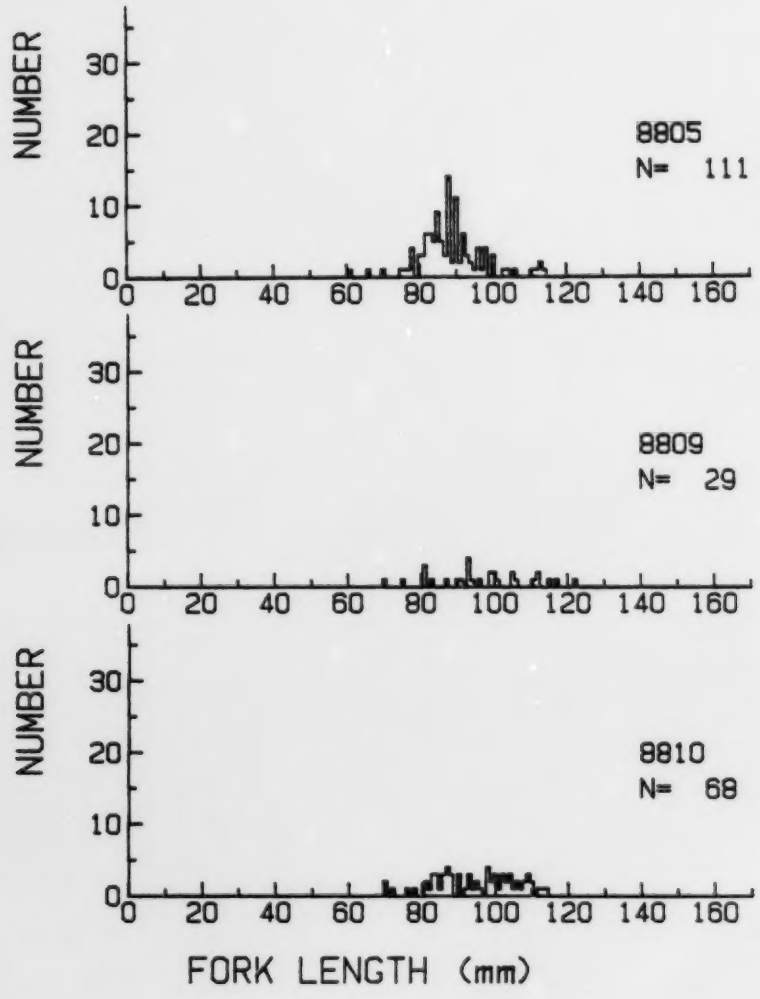

Fig. 1g. Monthly length-frequency distributions for pearl dace in L302N from May, 1988 (8805) until October, 1988 (8810).

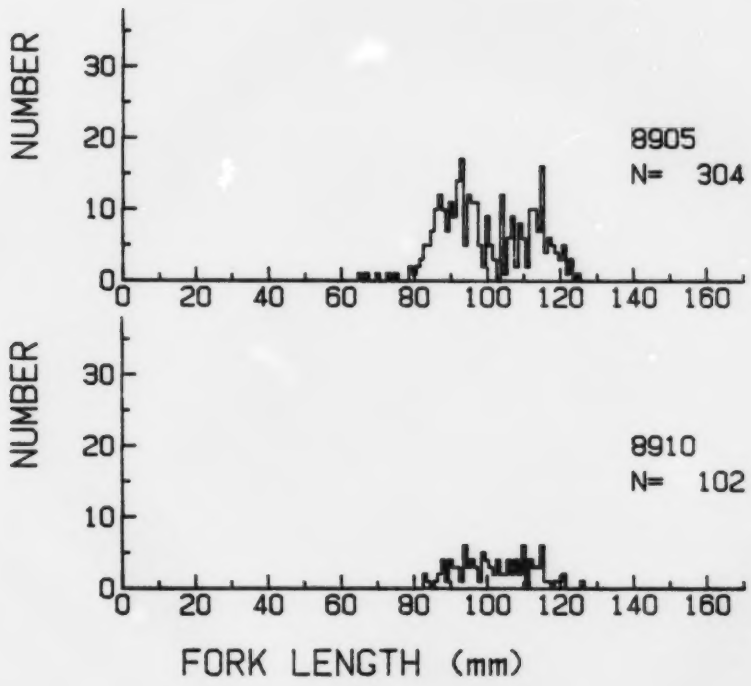

Fig. 1h. Monthly length-frequency distributions for pearl dace in L302N for May, 1989 (8905) and October, 1989 (8910).

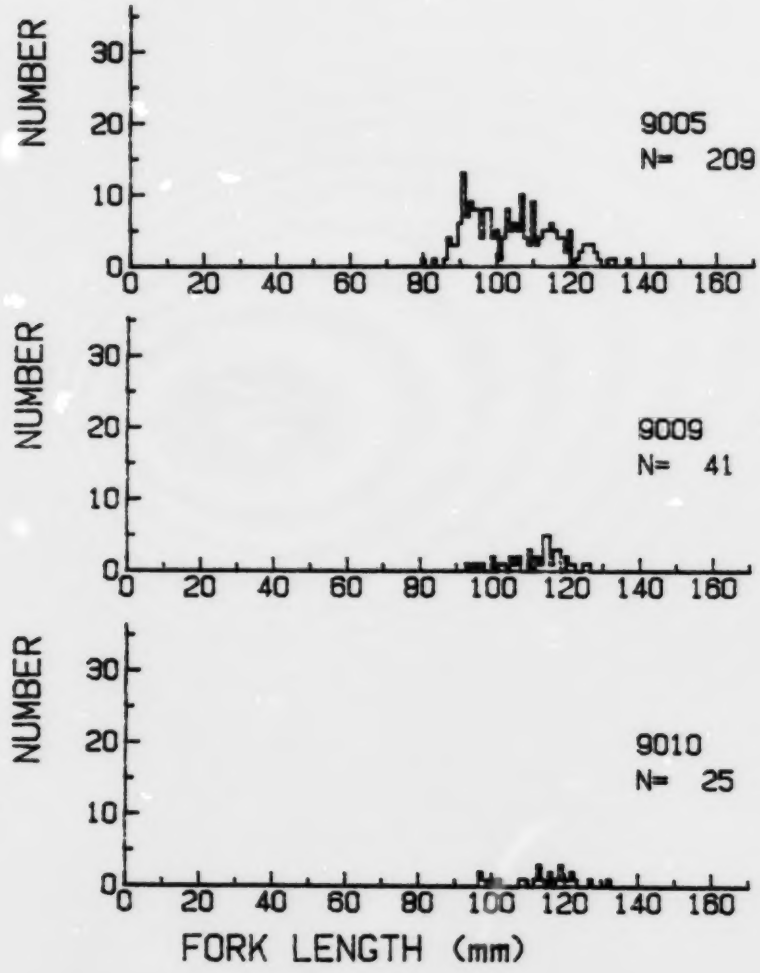

Fig. 11. Monthly length-frequency distributions for pearl dace in L302N from May, 1990 (9005) until October, 1990 (9010).

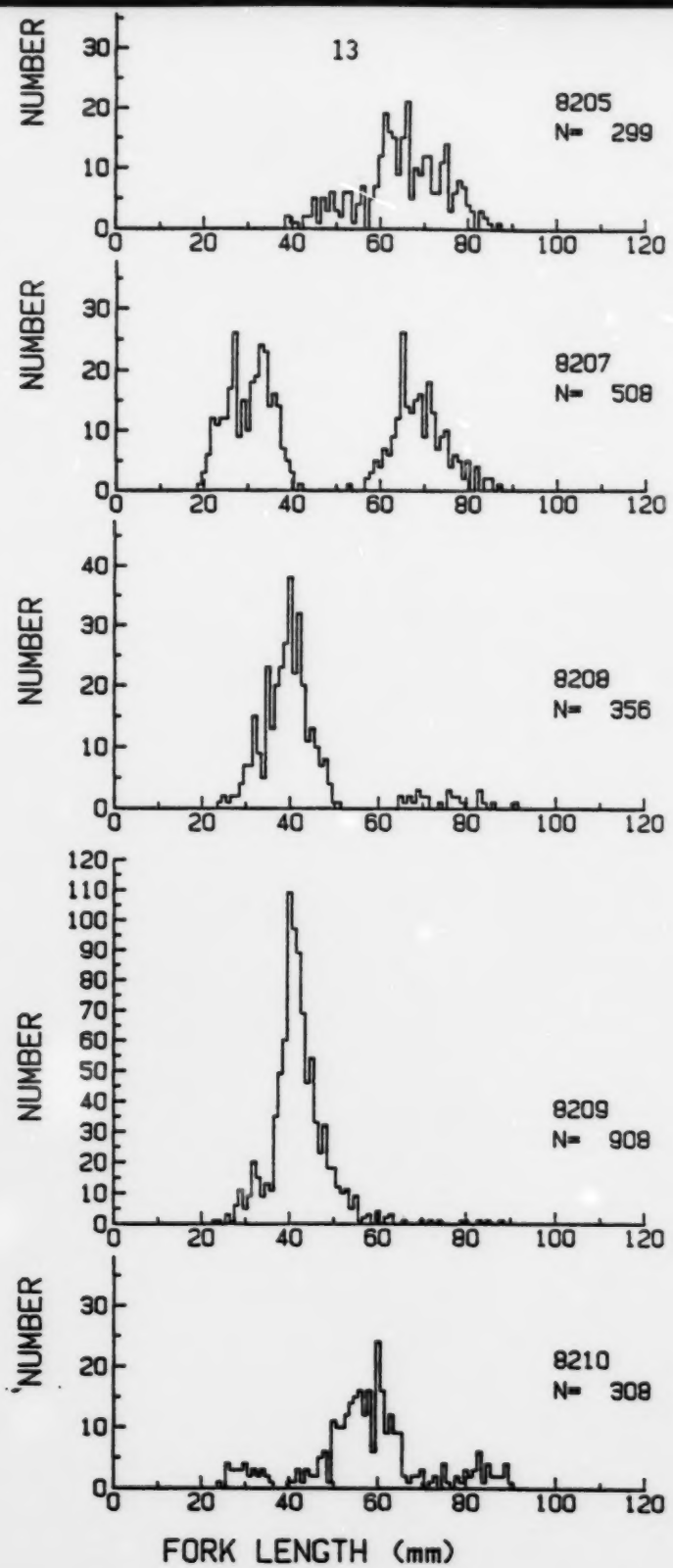

Fig. 2a. Monthly length-frequency distributions for fathead minnow in L302N from May, 1982 (8205) until October, 1982 (8210). Note change in scale of y-axis for September, 1982 (8209).

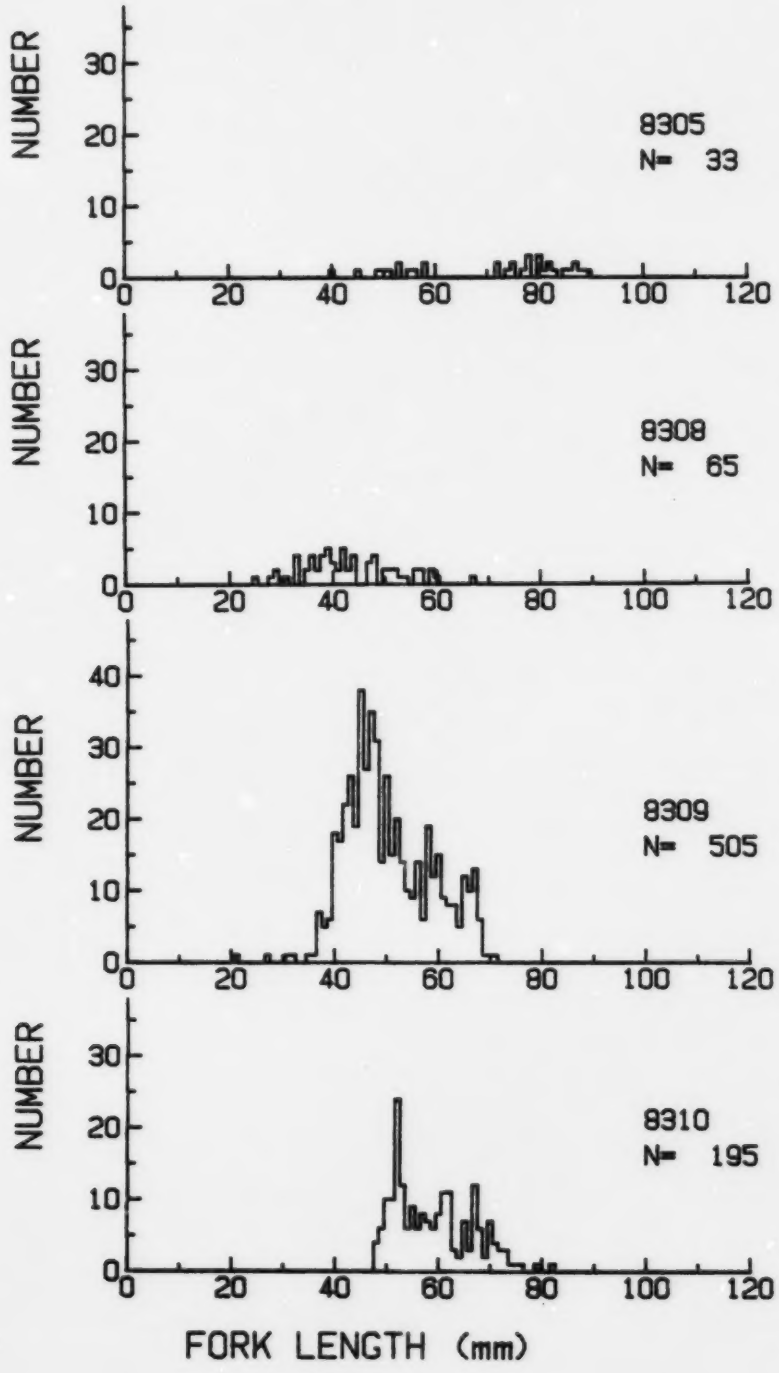

Fig. 2b. Monthly length-frequency distributions for fathead minnow in L302N from May, 1983 (8305) until October, 1983 (8310).

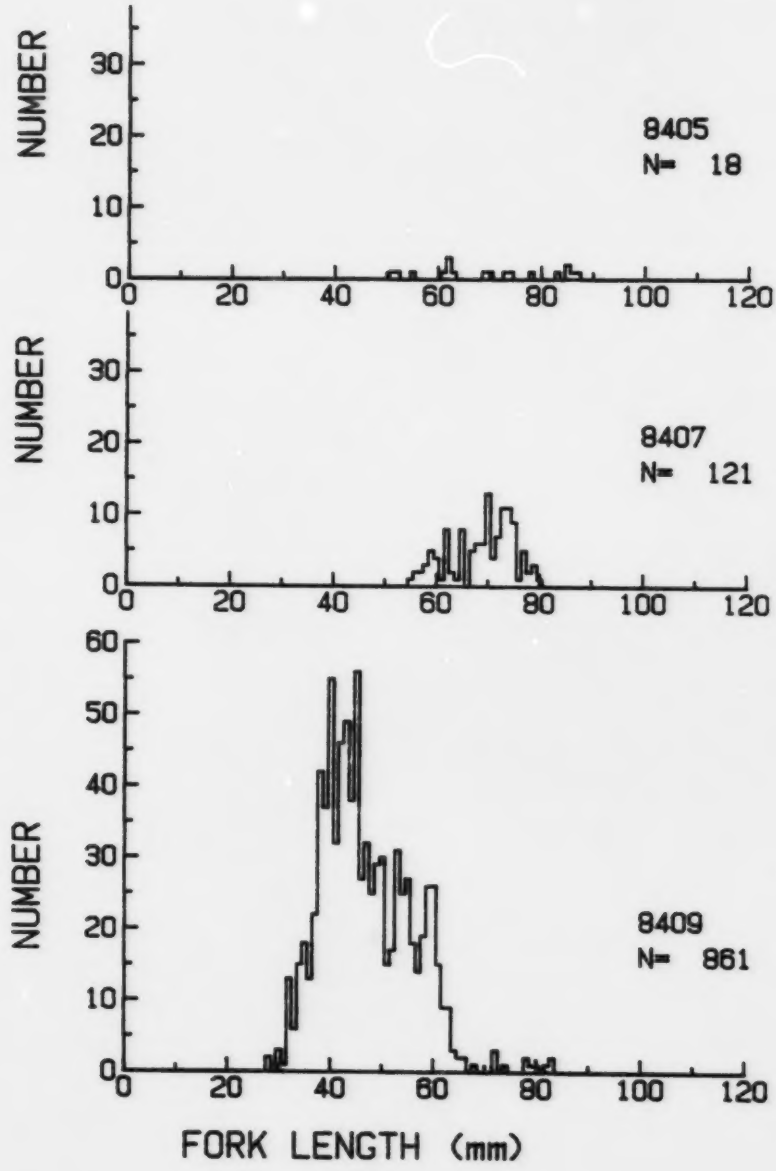

Fig. 2c. Monthly length-frequency distributions for fathead minnow in L302N from May, 1984 (8405) until September, 1984 (8409).

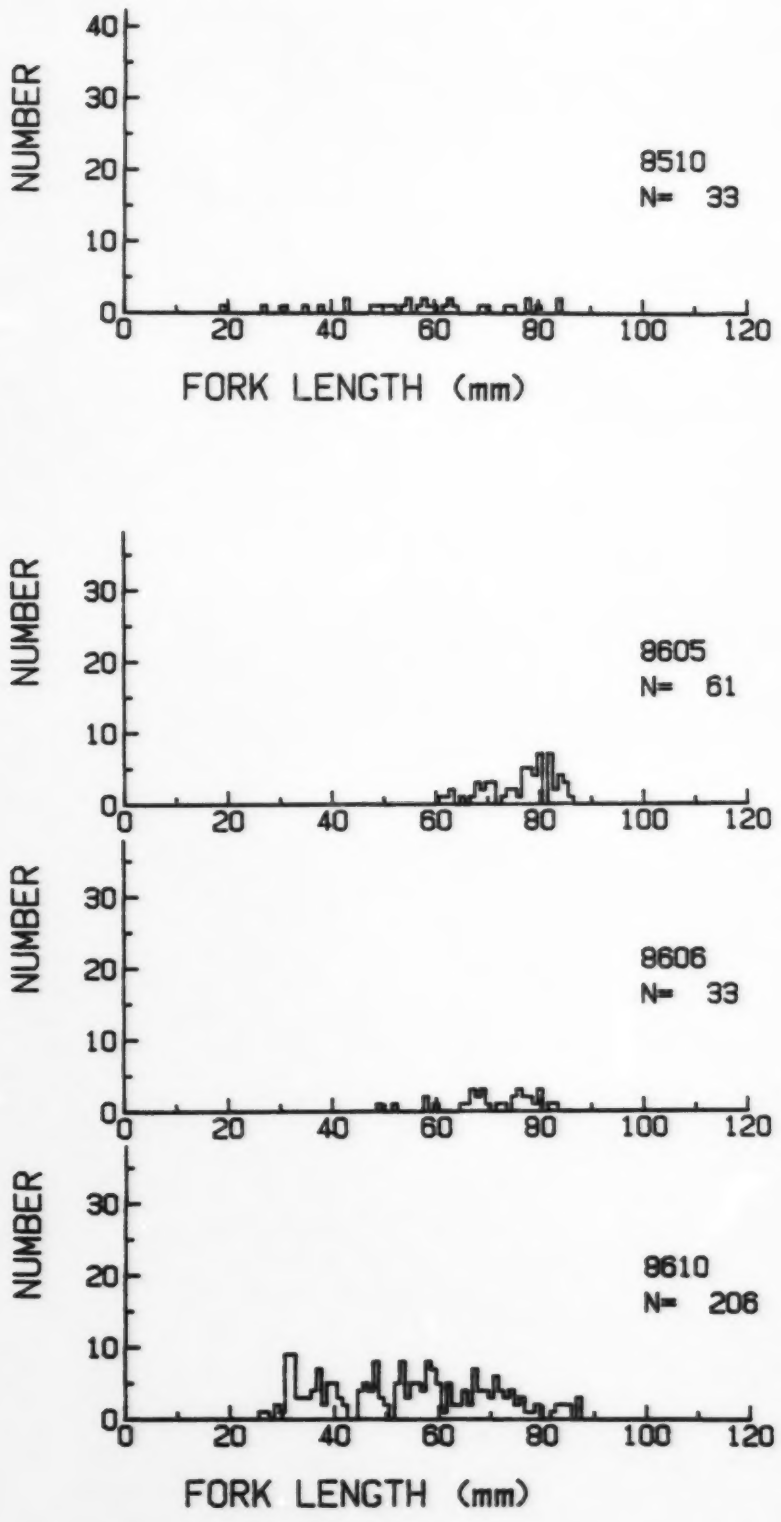

Fig. 2d. Monthly length-frequency distributions for fathead minnow in L302N from October, 1985 (8510) until October, 1986 (8610).

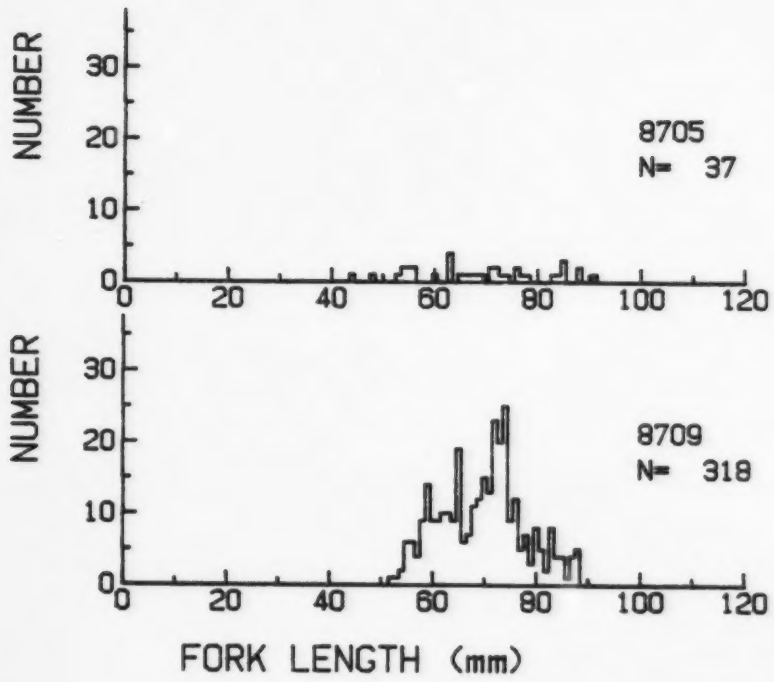

Fig. 2e. Monthly length-frequency distributions for fathead minnow in L302N for May, 1987 (8705) and September, 1987 (8709).

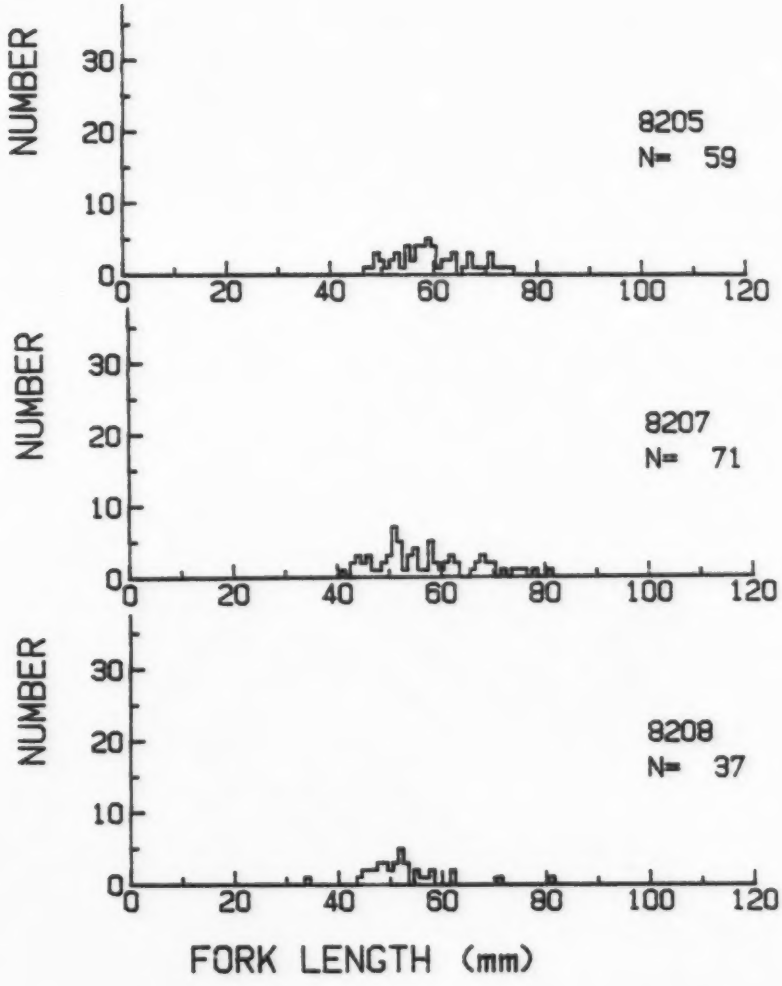

Fig. 3a. Monthly length-frequency distributions for finescale dace in L302N from May, 1982 (8205) until August, 1982 (8208).

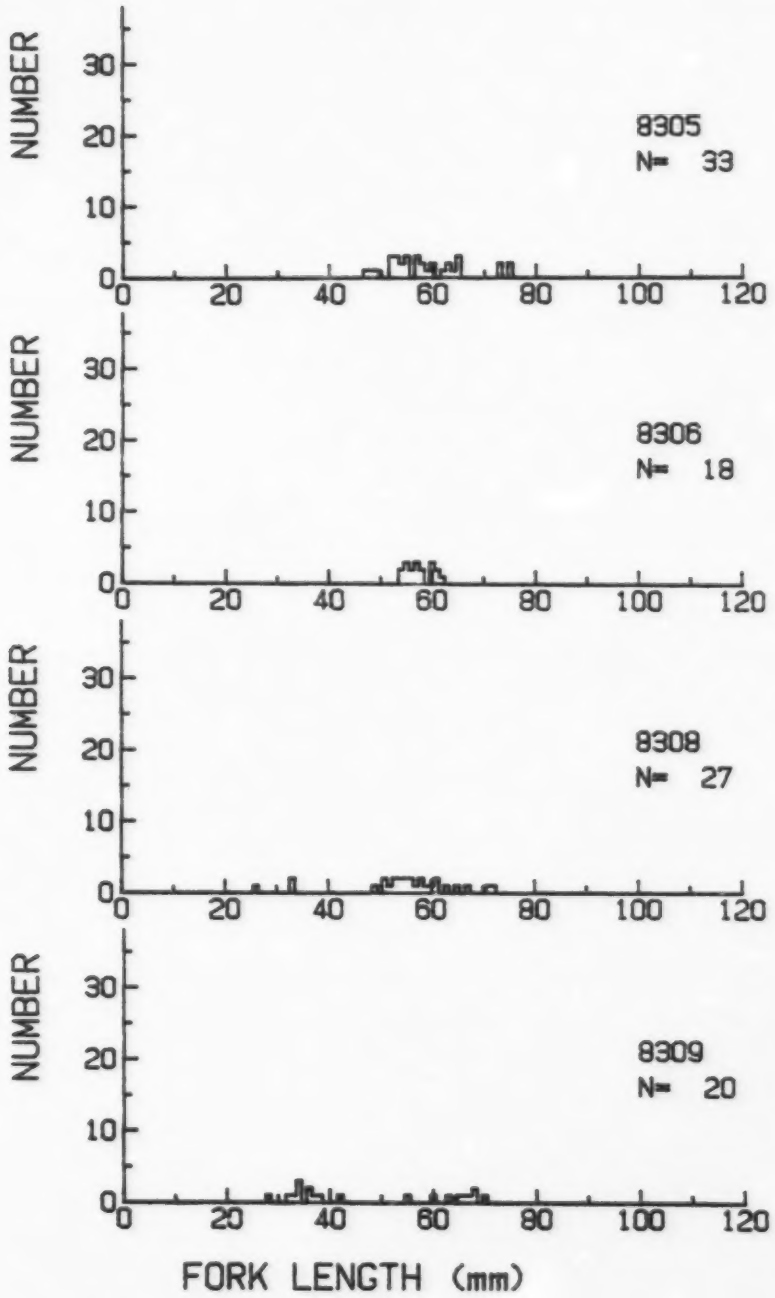

Fig. 3b. Monthly length-frequency distributions for finescale dace in L302N from May, 1983 (8305) until September, 1983 (8309).

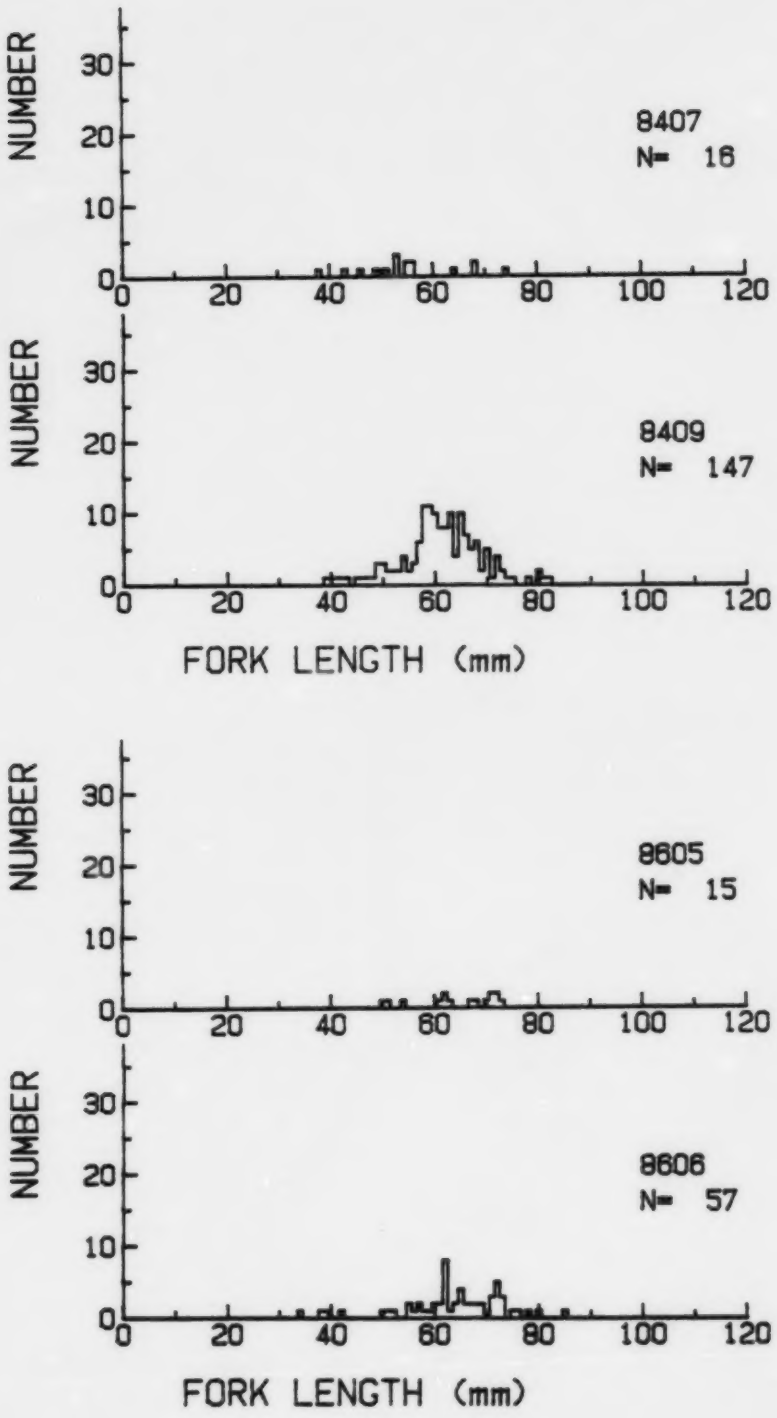

Fig 3c. Monthly length-frequency distributions for finescale dace in L302 from July, 1984 (8407) until June, 1986 (8606).

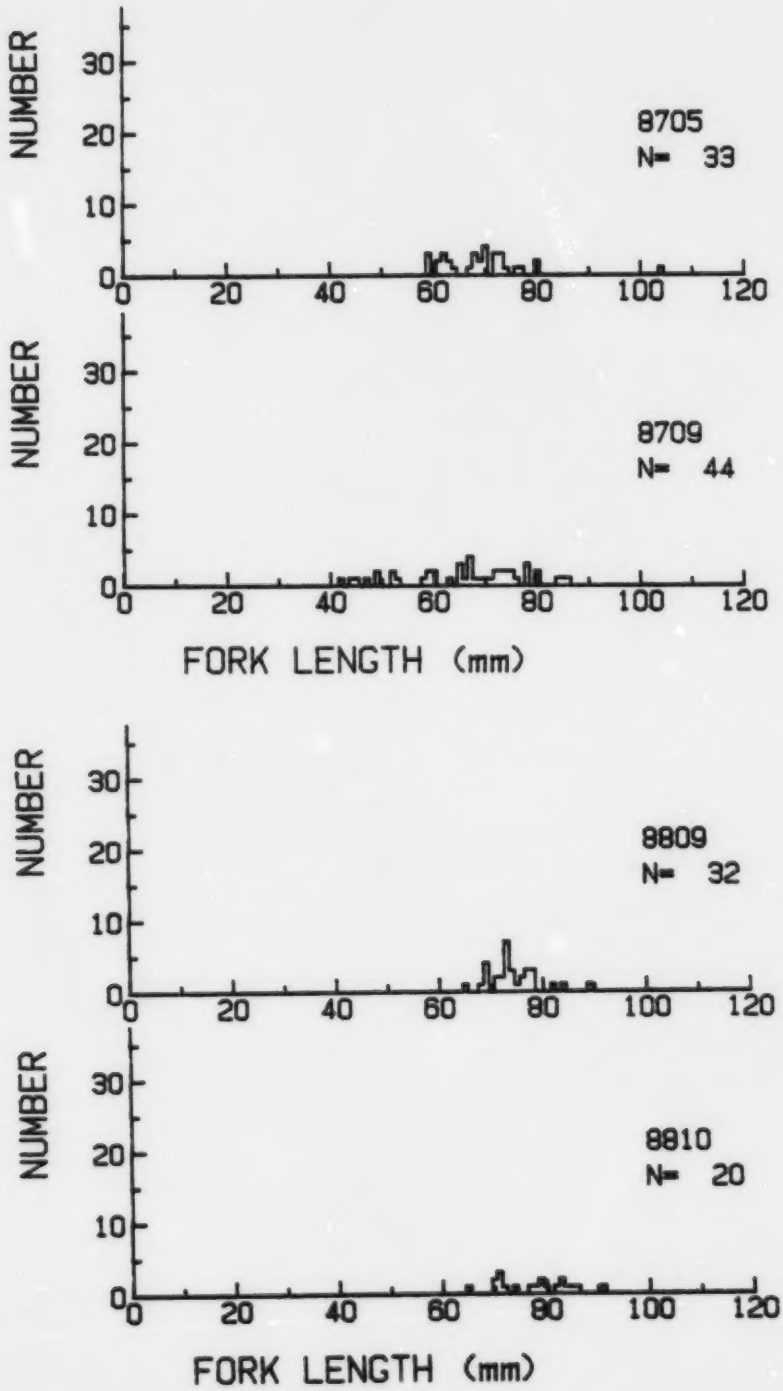

Fig. 3d. Monthly length-frequency distributions for finescale dace in L302N from May, 1987 (8705) until October, 1988 (8810).

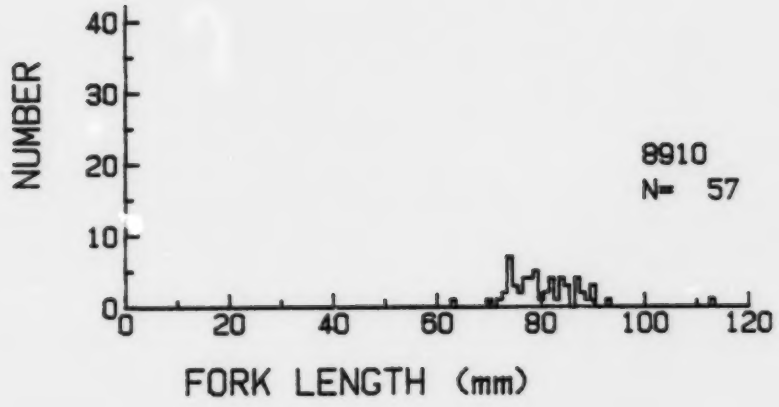

Fig. 3e. Monthly length-frequency distributions for finescale dace in L302N for October, 1989 (8910).

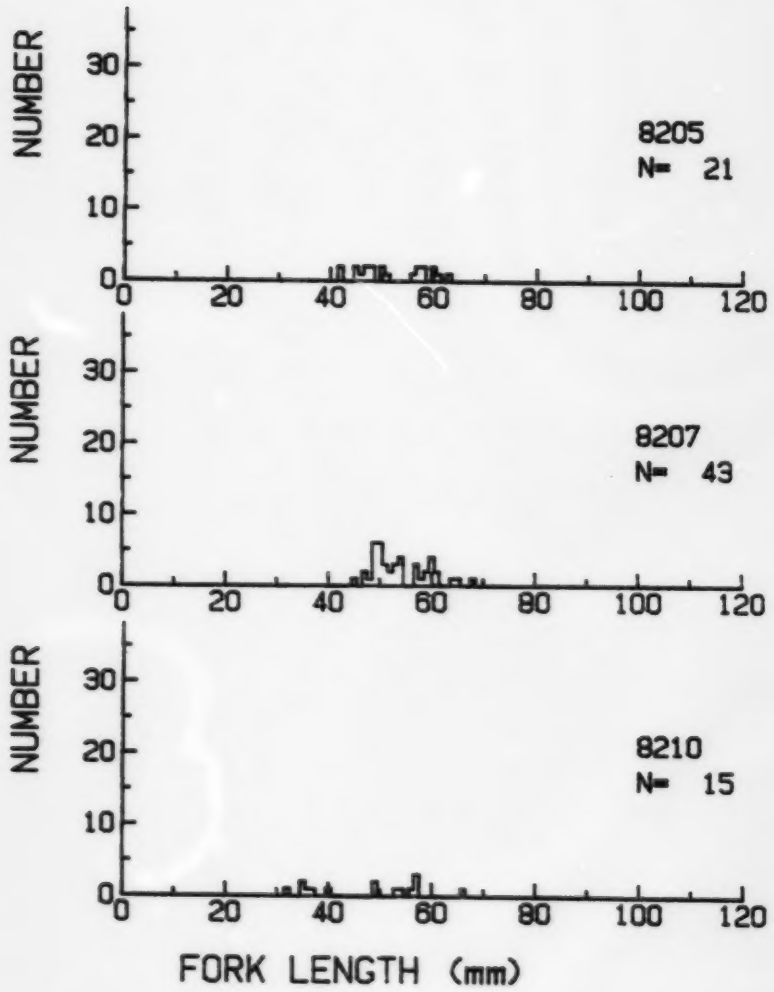

Fig. 4a. Monthly length-frequency distributions for northern redbelly dace in L302N from May, 1982 (8205) until October, 1982 (8210).

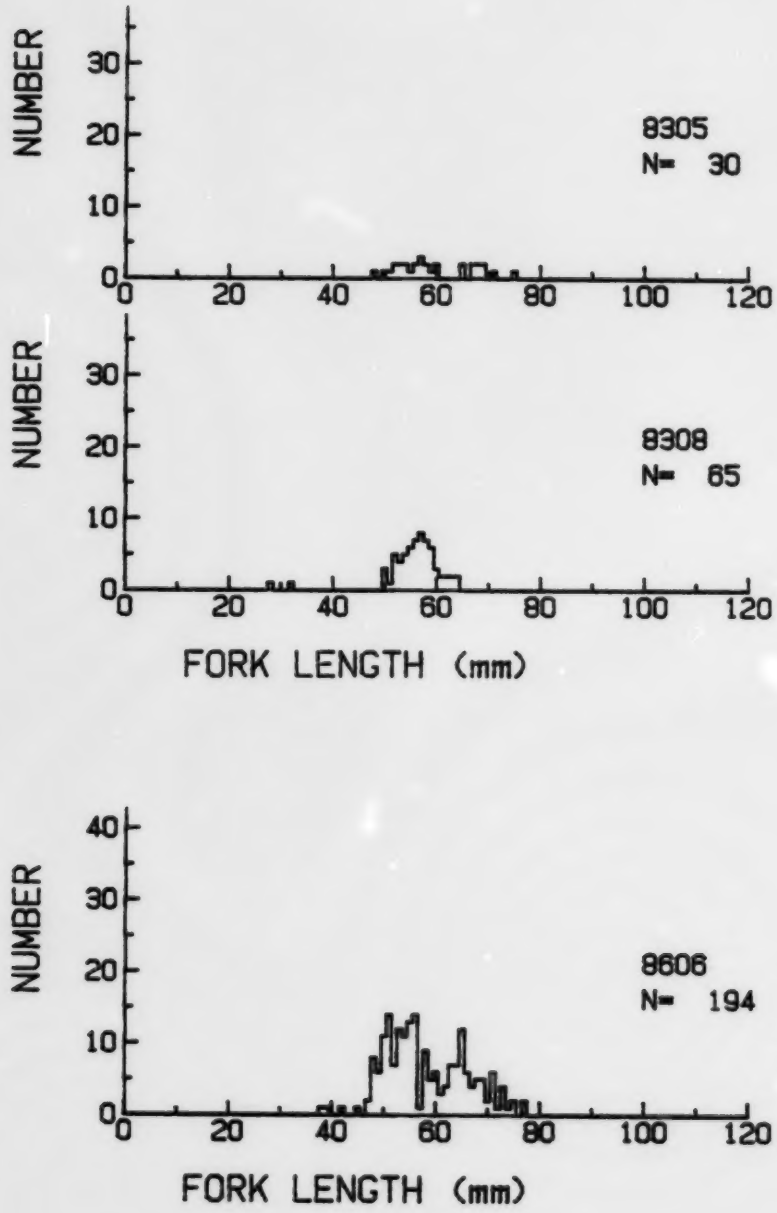

Fig. 4b. Monthly length-frequency distributions for northern redbelly dace in L302N from May, 1983 (8305) until June, 1986 (8606).

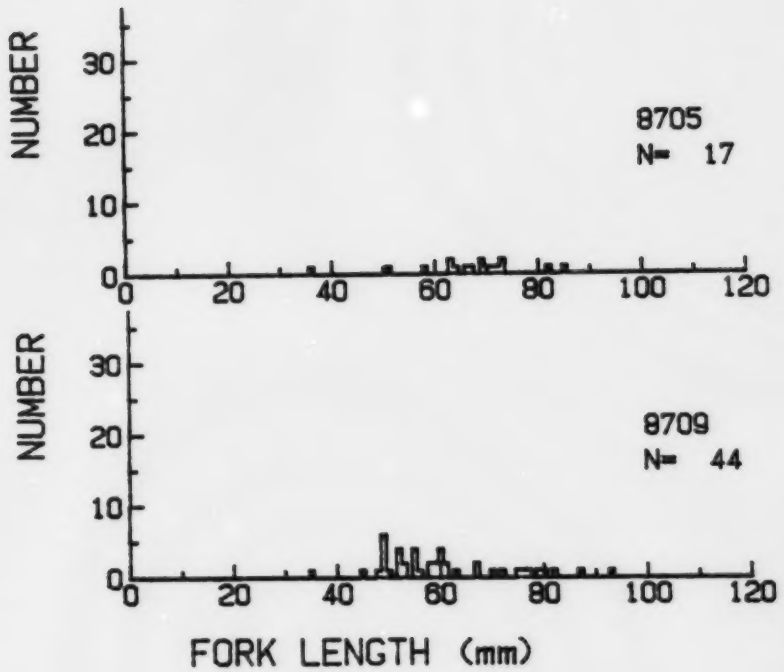

Fig. 4c. Monthly length-frequency distributions for northern redbelly dace in L302N for May, 1987 (8705) and September, 1987 (8709).

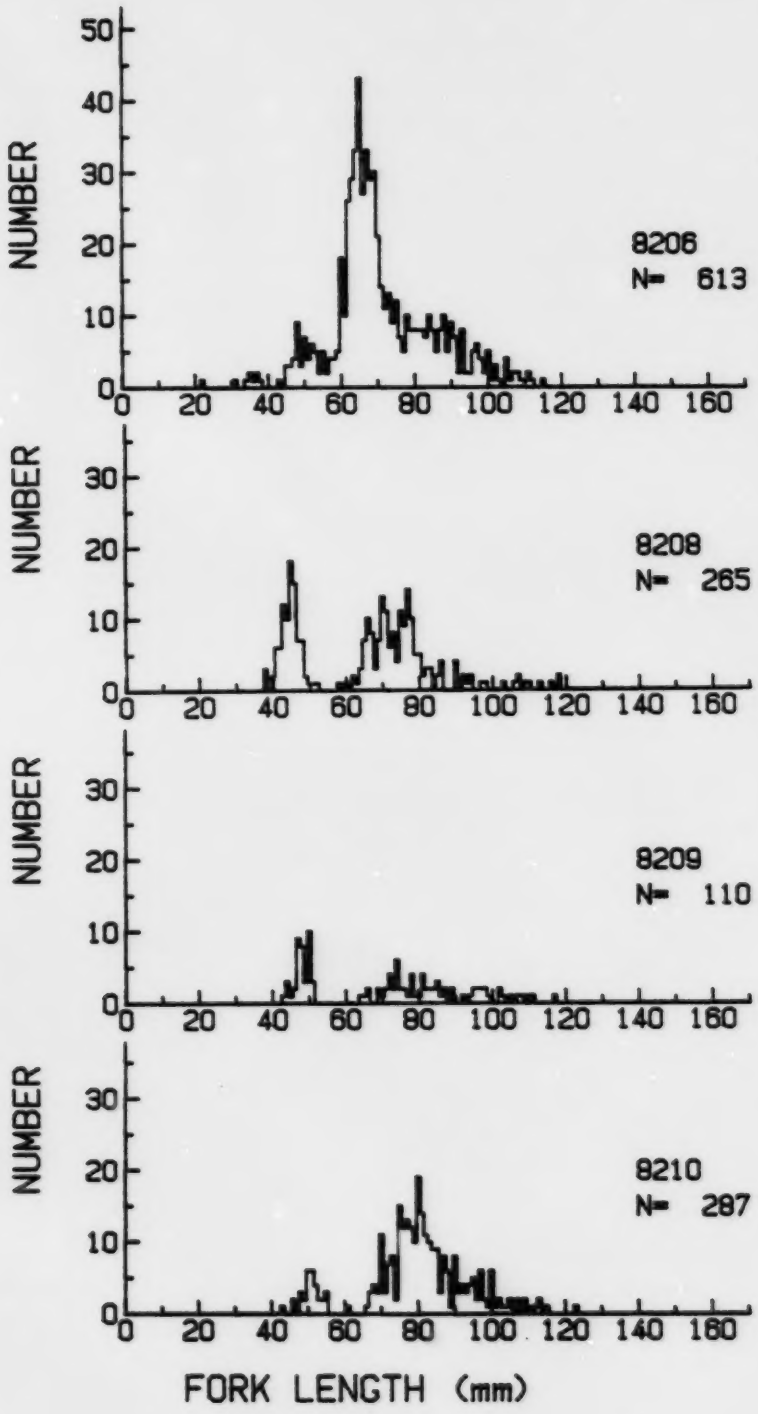

Fig. 5a. Monthly length-frequency distributions for pearl dace in L302S from June, 1982 (8206) until October, 1982 (8210).

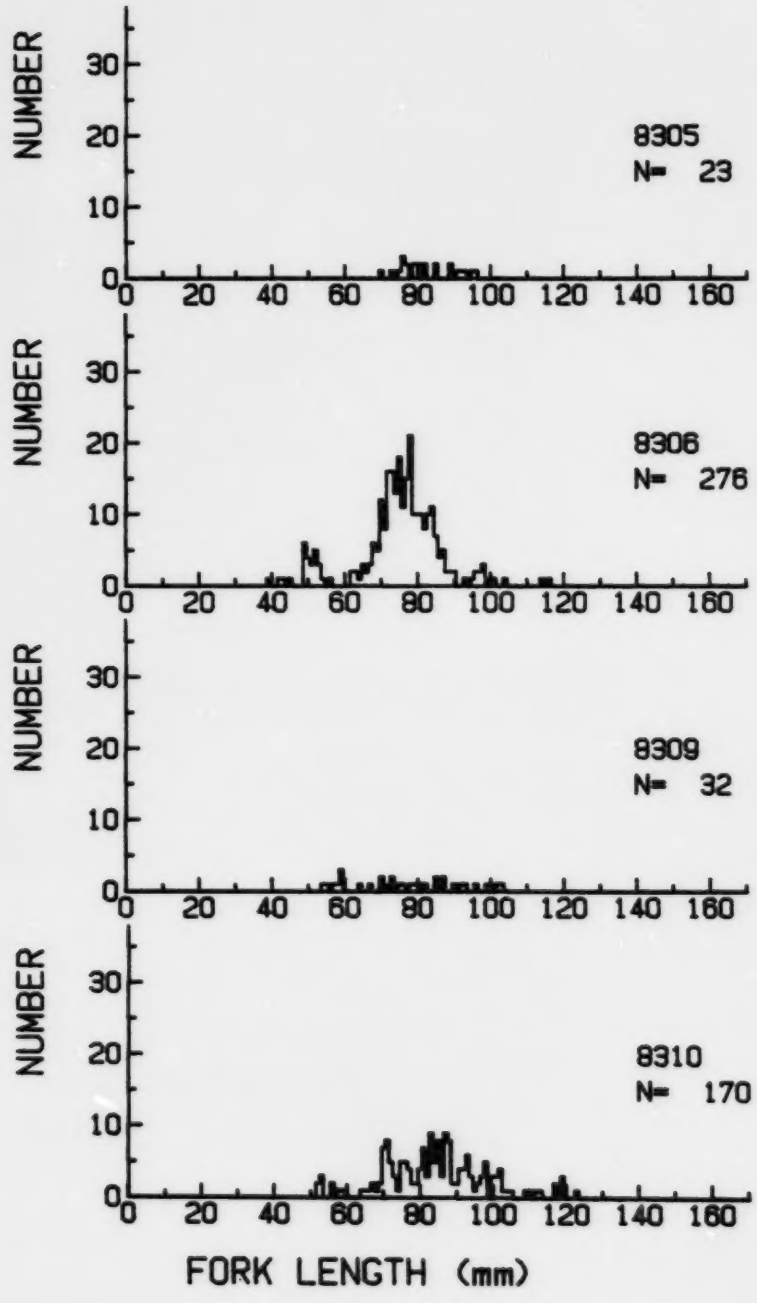

Fig. 5b. Monthly length-frequency distributions for pearl dace in L302S from May, 1983 (8305) until October, 1983 (8310).

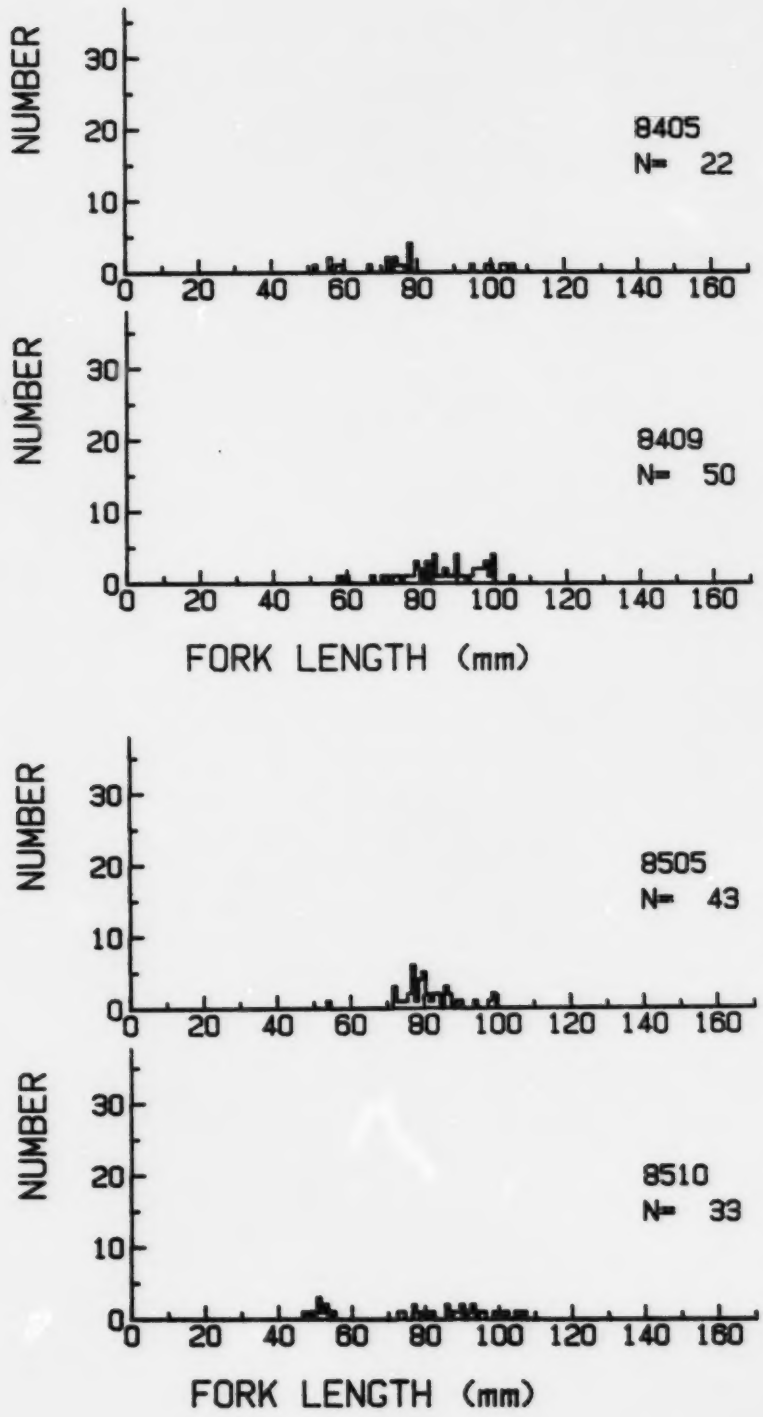

Fig. 5c. Monthly length-frequency distributions for pearl dace in L302S from May, 1984 (8405) until October, 1985 (8510).

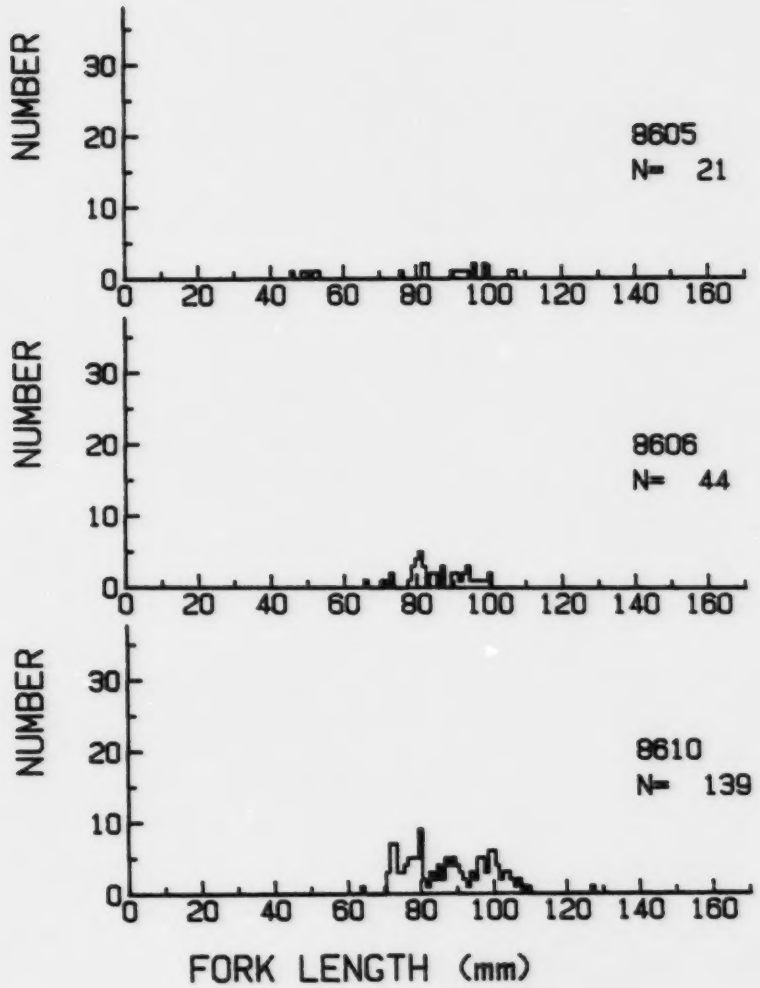

Fig. 5d. Monthly length-frequency distributions for pearl dace in L302S from May, 1986 (8605) until October, 1986 (8610).

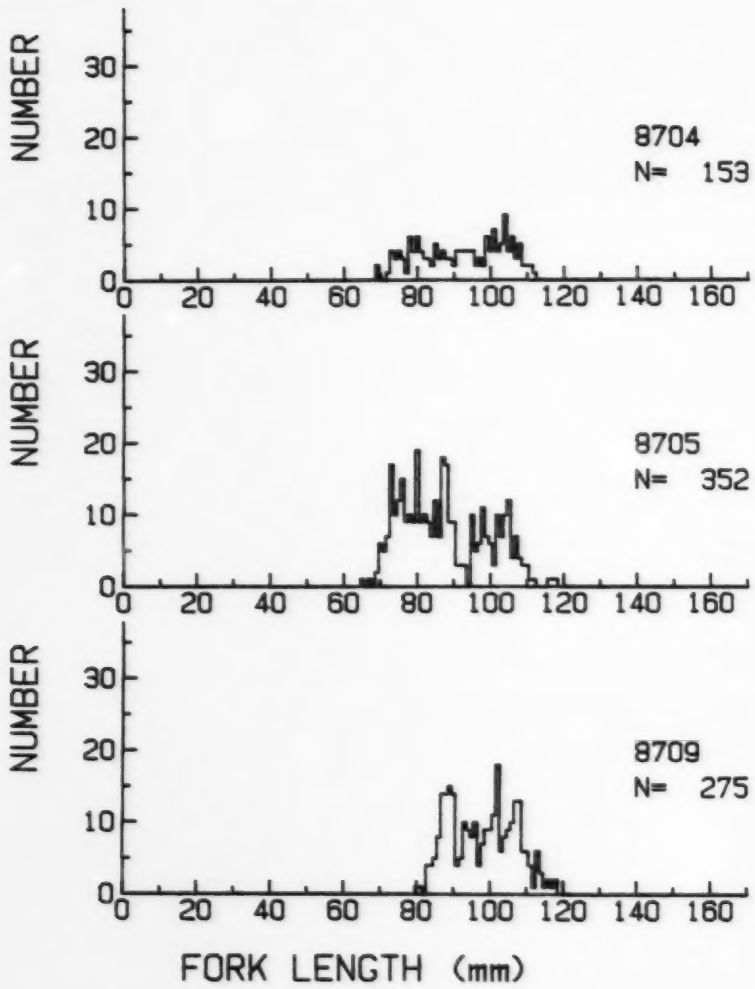

Fig. 5e. Monthly length-frequency distributions for pearl dace in L302S from April, 1987 (8704) until September, 1987 (8709).

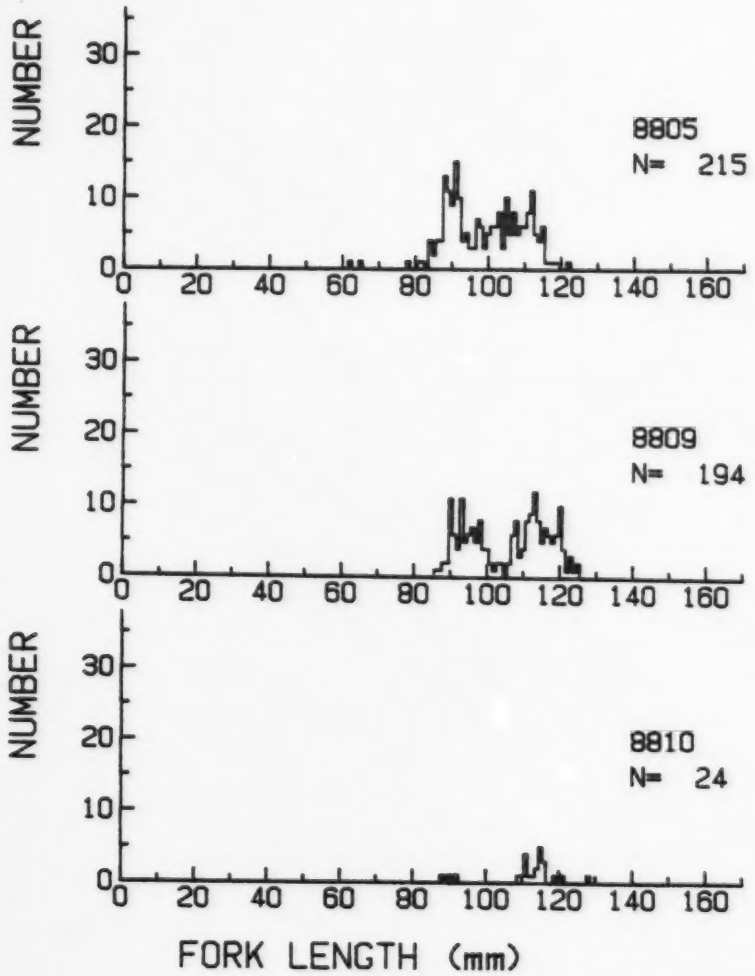

Fig. 5f. Monthly length-frequency distributions for pearl dace in L302S from May, 1988 (8805) until October, 1988 (8810).

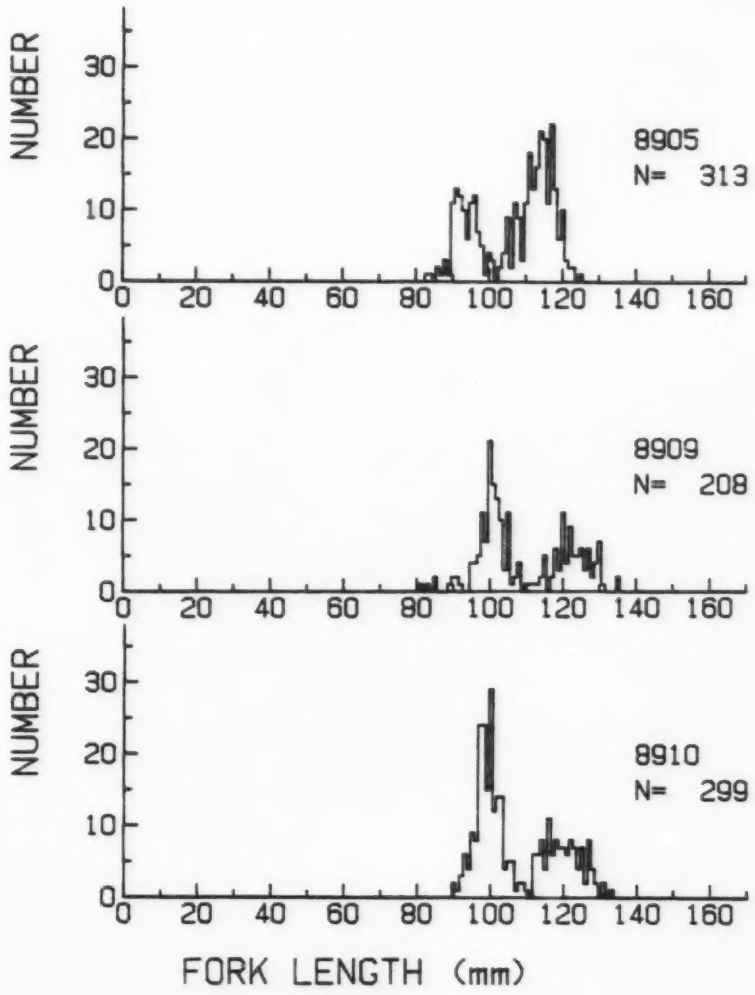

Fig. 5g. Monthly length-frequency distributions for pearl dace in L302S from May, 1989 (8905) until October, 1989 (8910).

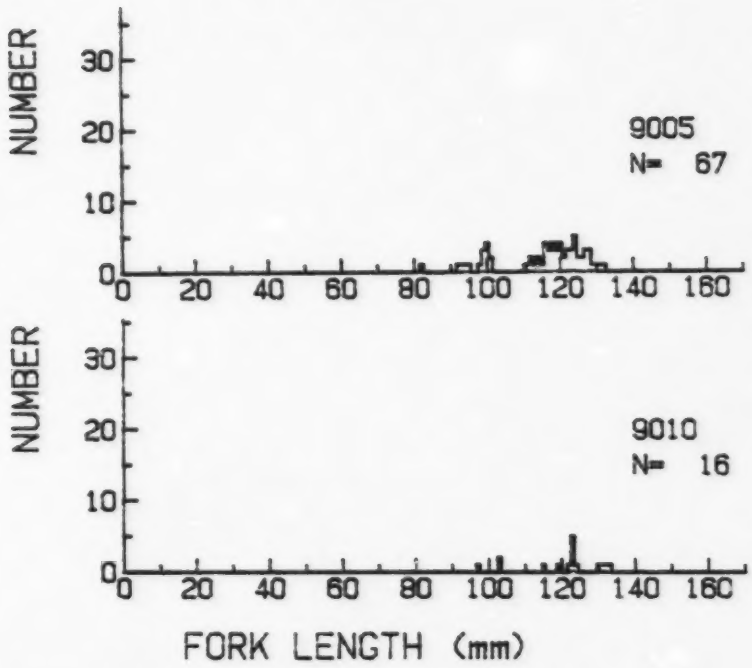

Fig. 5h. Monthly length-frequency distributions for pearl dace in L302S for May, 1990 (9005) and October, 1990 (9010).

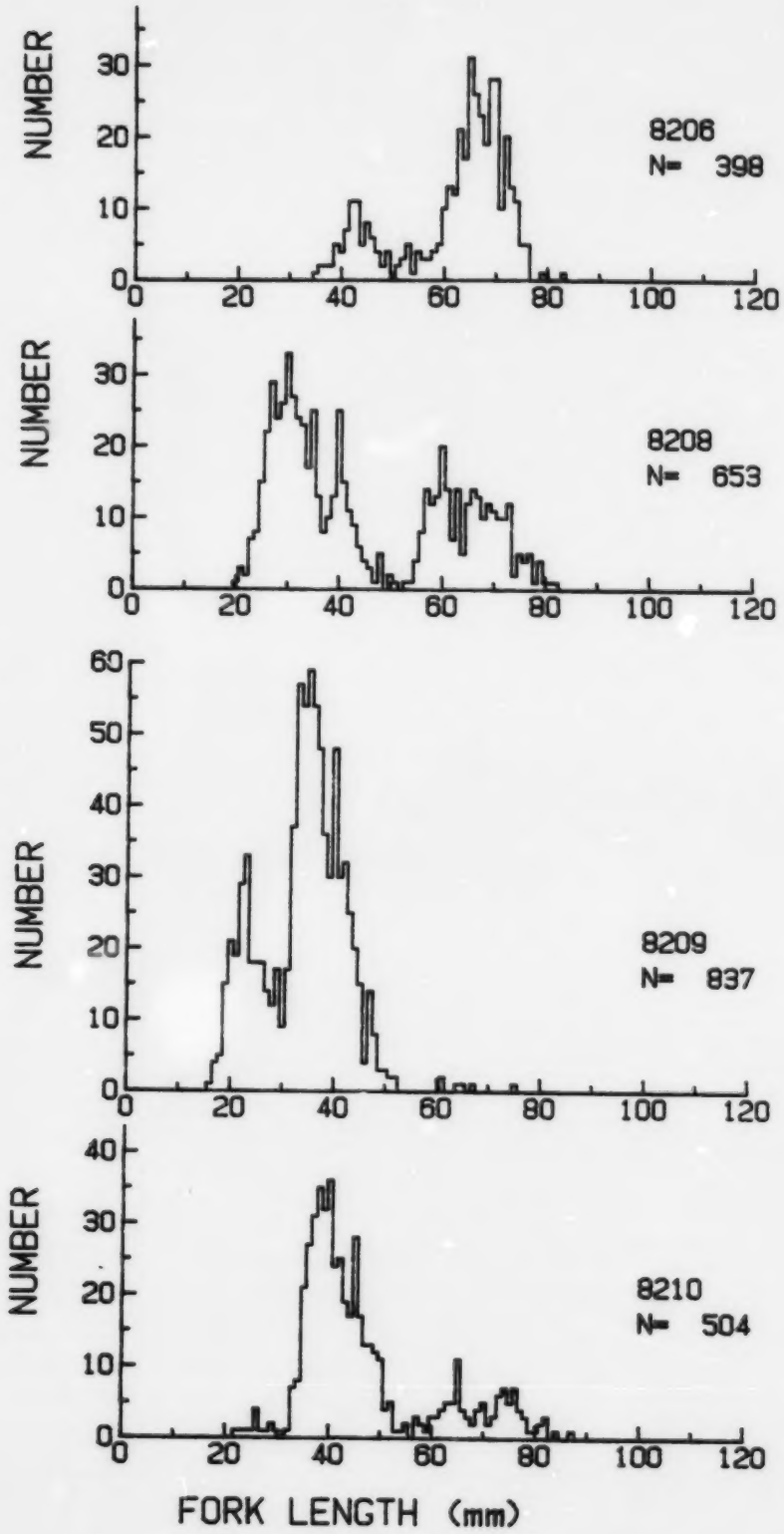

Fig. 6a. Monthly length-frequency distributions for fathead minnow in L302S from June, 1982 (8206) until October, 1982 (8210).

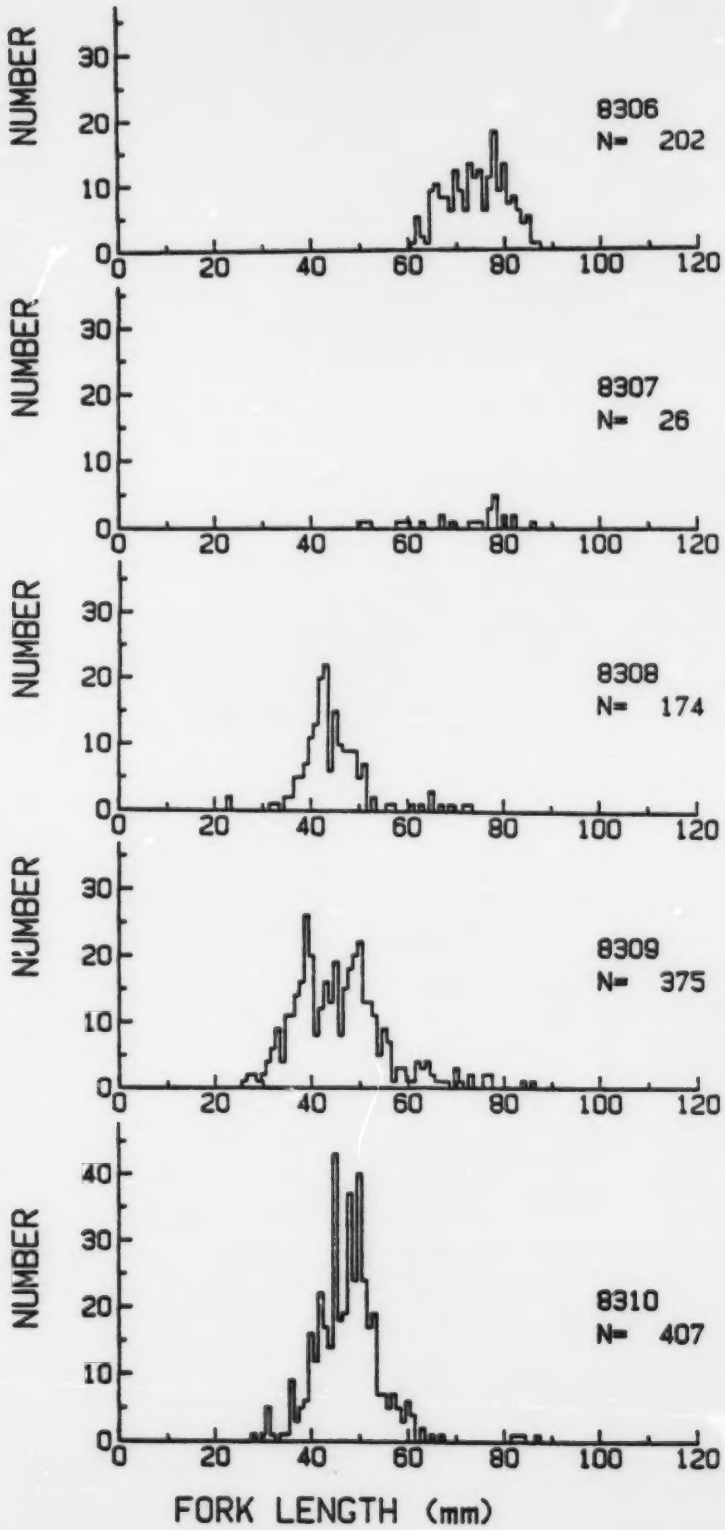

Fig. 6b. Monthly length-frequency distributions for fathead minnow in L302S from June, 1983 (8306) until October, 1983 (8310).

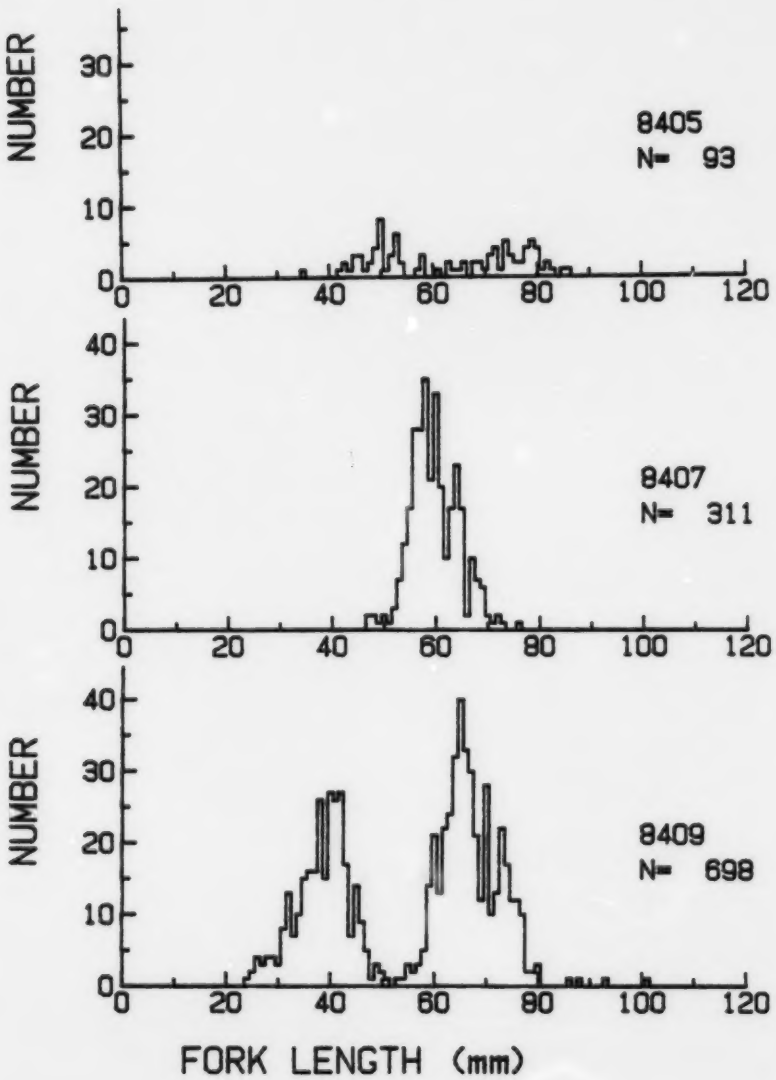

Fig. 6c. Monthly length-frequency distributions for fathead minnow in L302S from May, 1984 (8405) until September, 1984 (8409).

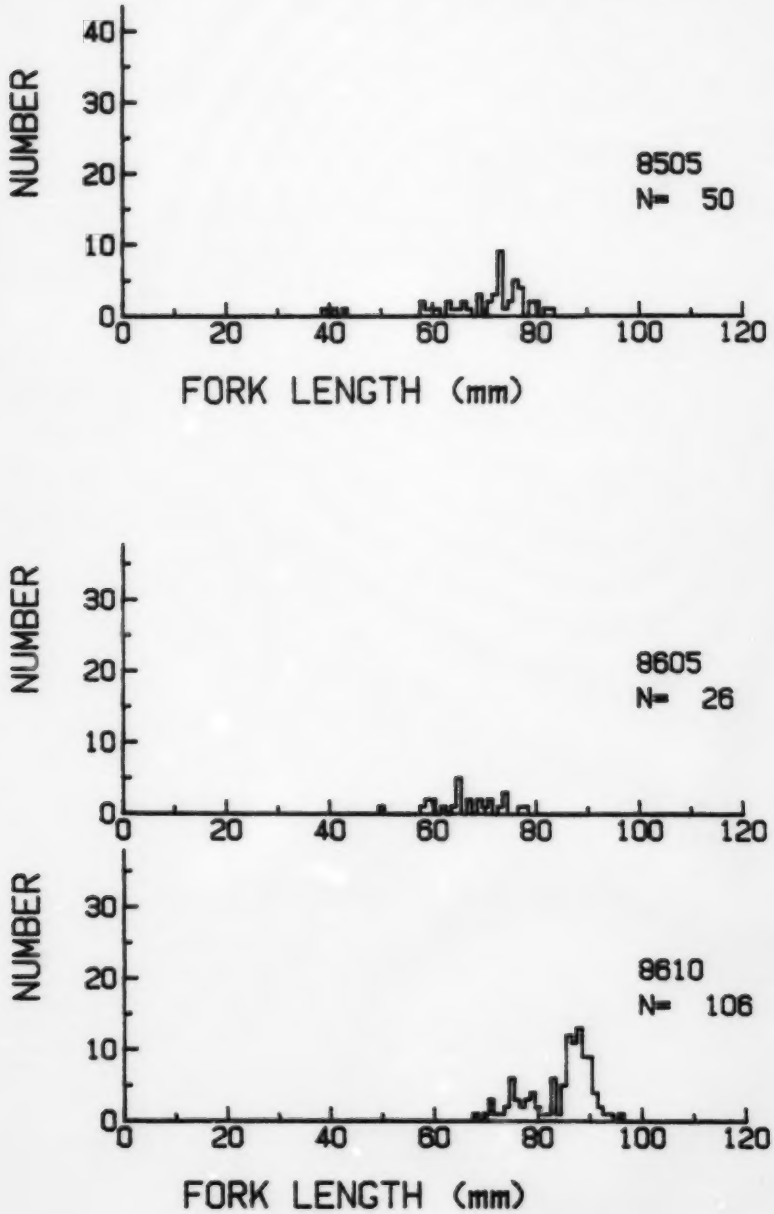

Fig. 6d. Monthly length-frequency distributions for fathead minnow in L302S from May, 1985 (8505) until October, 1986 (8610).

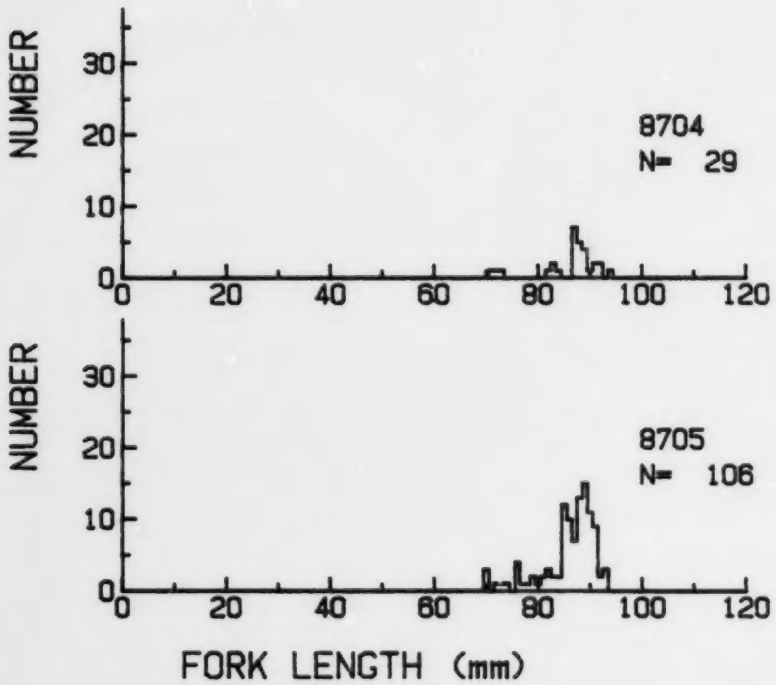

Fig. 6e. Monthly length-frequency distributions for fathead minnow in L302S from April, 1987 (8704) until May, 1987 (8705).

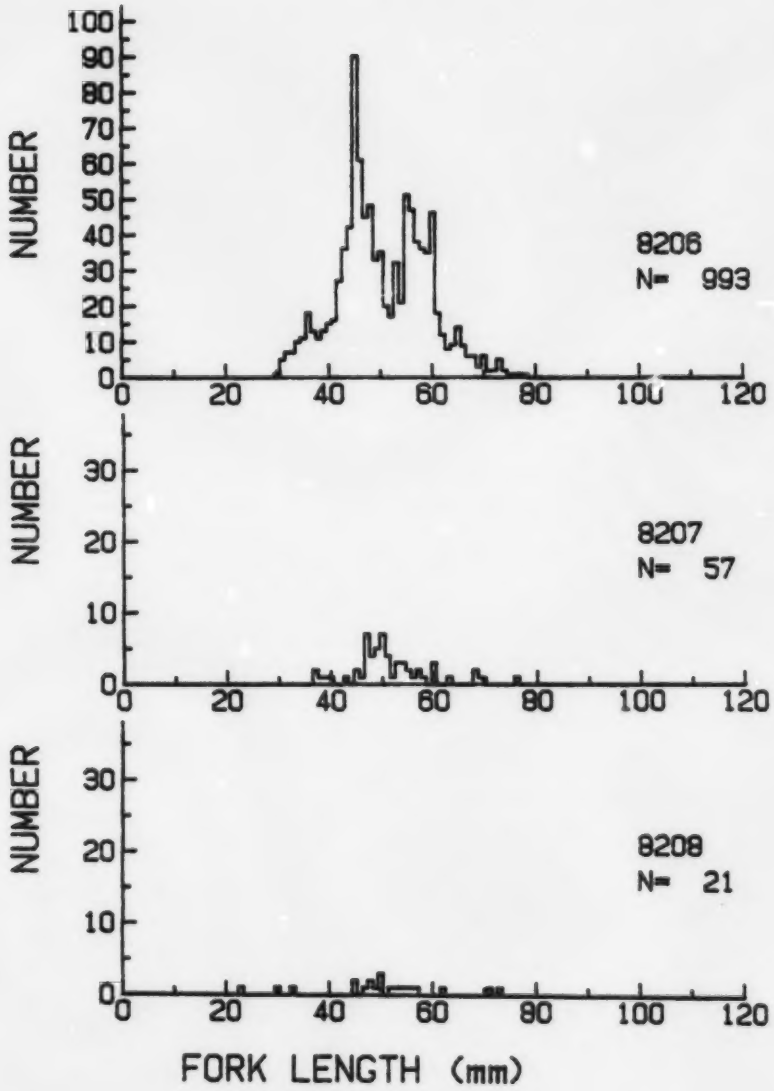

Fig. 7a. Monthly length-frequency distributions for finescale dace in L302S from June, 1982 (8206) until August, 1982 (8208). Note change in scale of y-axis for June, 1982 (8206).

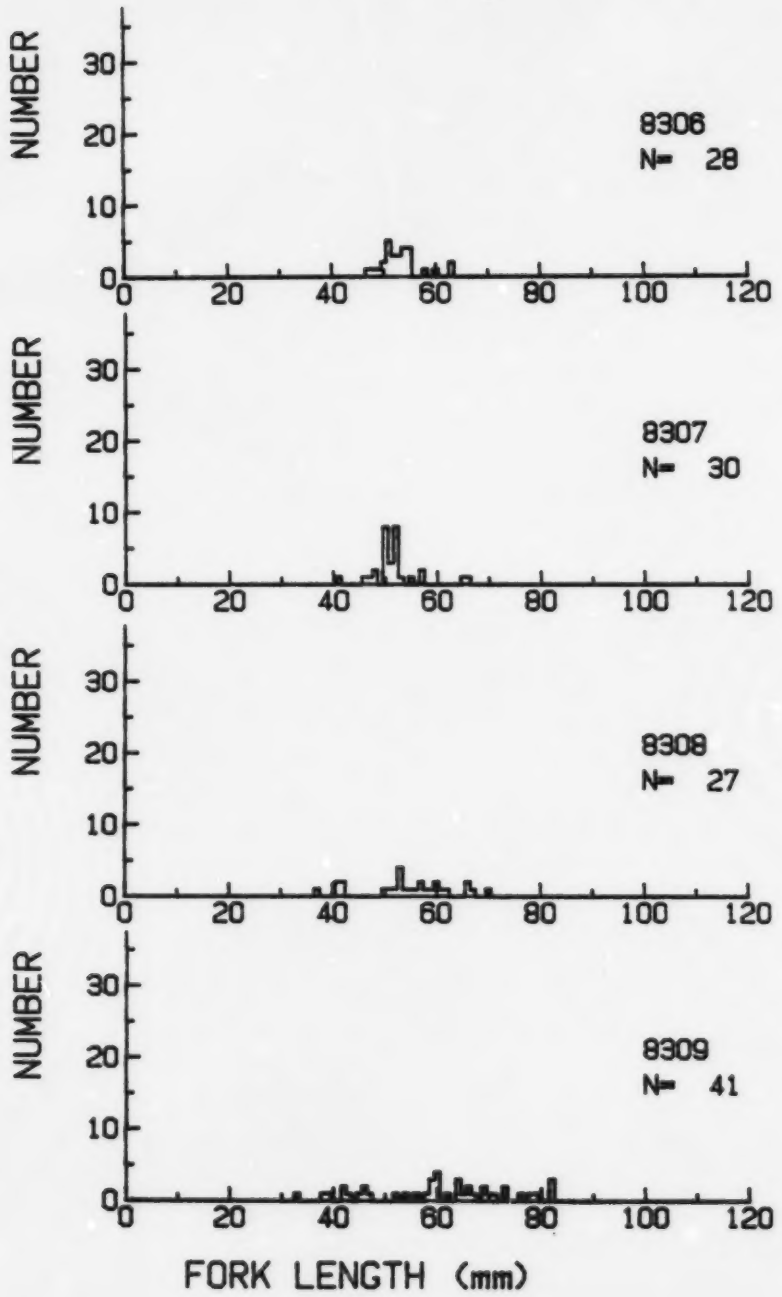

Fig. 7b. Monthly length-frequency distributions for finescale dace in L302S from June, 1983 (8306) until September, 1983 (8309).

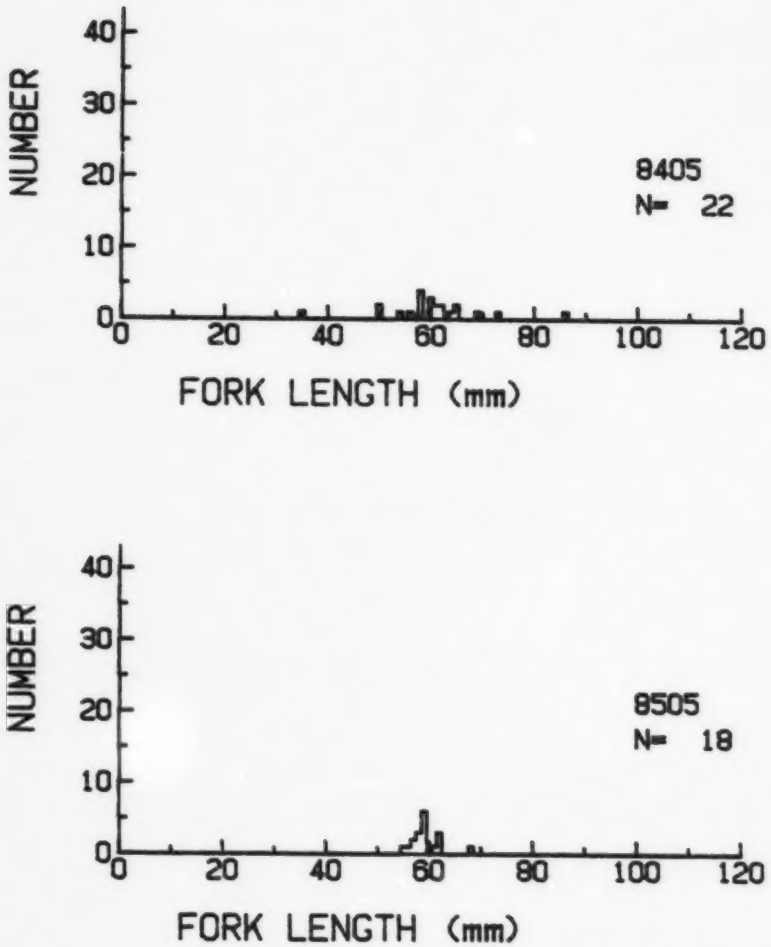

Fig. 7c. Monthly length-frequency distributions for finescale dace in L302S for May, 1984 (8405) and May, 1985 (8505).

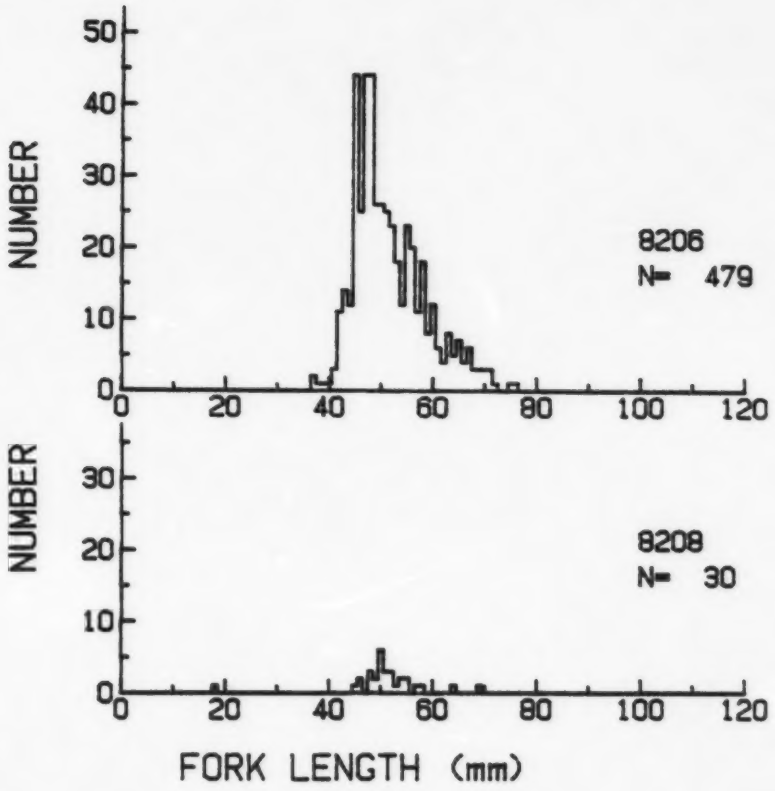

Fig. 8a. Monthly length-frequency distributions for northern redbelly dace in L302S for June, 1982 (8206) and August, 1982 (8208).

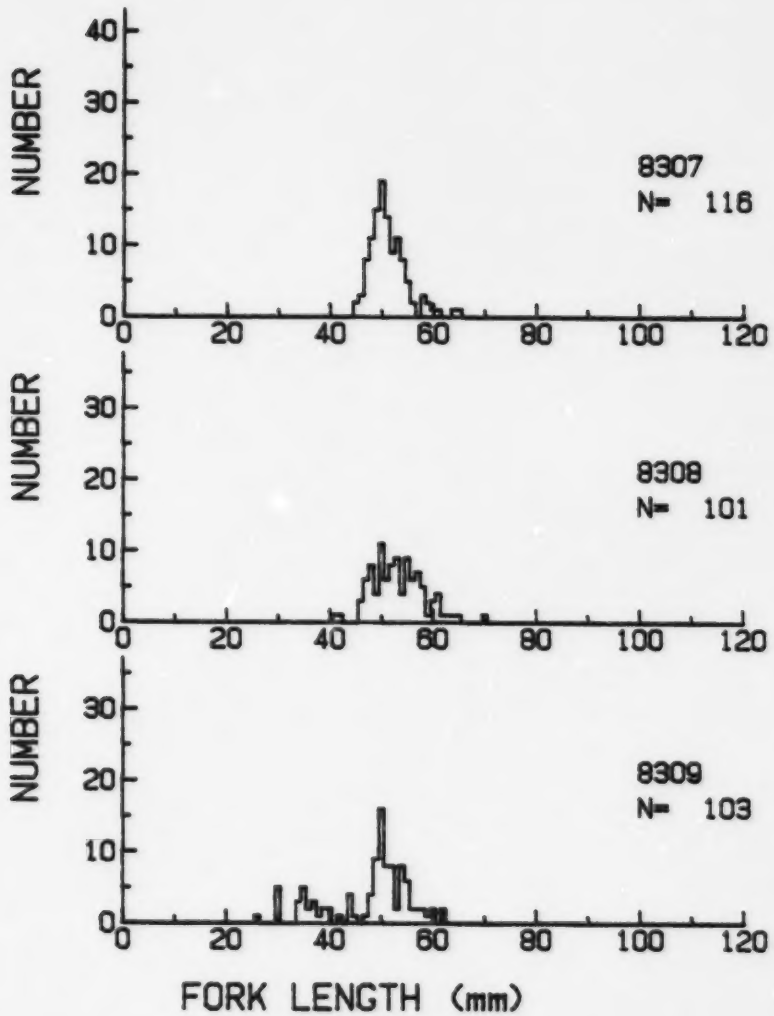

Fig. 8b. Monthly length-frequency distributions for northern redbelly dace in L302S from July, 1983 (8307) until September, 1983 (8309).